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VOL. 49. Ser. A. Part 6. pp. 269–328. JUNE, 1961

THE REVIEW OF APPLIED ENTOMOLOGY

SERIES A: AGRICULTURAL

ISSUED BY THE COMMONWEALTH INSTITUTE OF ENTOMOLOGY

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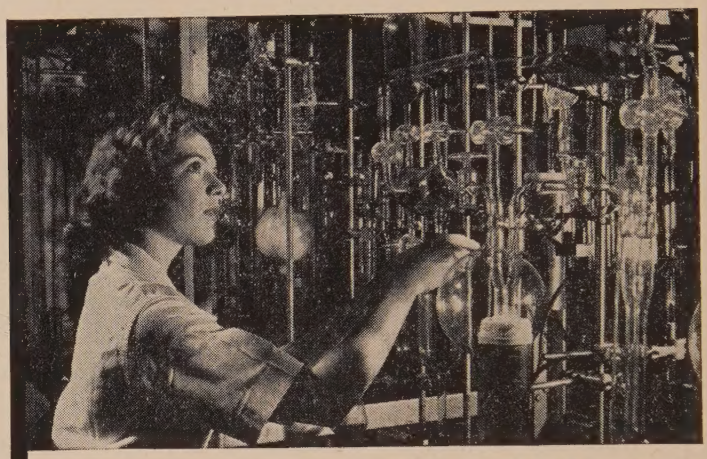

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TANADA (Y.) & CHANG (G. Y.). **A cytoplasmic polyhedrosis of the armyworm,** *Pseudaletia unipuncta* **(Haworth) (Lepidoptera, Noctuidae).**—*J. Insect Path.* **2** no. 3 pp. 201–208, 2 figs., 8 refs. New York, N.Y., 1960.

The following is virtually the authors' summary. Larvae of *Pseudaletia unipuncta* (Haw.) in a laboratory stock in California were recently found suffering from a cytoplasmic polyhedrosis virus. Histological sections showed the cytoplasm of mid-gut cells to contain polyhedra. Electron micrographs revealed the presence of spherical particles within the polyhedra. This is the fourth type of insect virus reported from this armyworm [*cf. R.A.E.*, A **48** 509, etc.], and *P. unipuncta* is the only insect known at present to be susceptible to the four types of insect viruses demonstrated with the electron microscope. Externally, the diseased larvae exhibited only a slight discoloration over the mid-gut region; severely infected larvae gradually shrank and were greatly reduced in size at death. Many larvae, after being fed the virus, were capable of surviving and of developing to adults. Larvae in the first three instars were more susceptible to a lethal infection than those in the three older instars. When an adult developed from a larva exposed to cytoplasmic polyhedrosis virus, its mid-gut epithelium was found to be infected with the virus.

TAMASHIRO (M.). **The susceptibility of** *Bracon*-**paralyzed** *Corcyra cephalonica* **(Stainton) to** *Bacillus thuringiensis* **var.** *thuringiensis* **Berliner.**—*J. Insect Path.* **2** no. 3 pp. 209–219, 17 refs. New York, N.Y., 1960.

The following is substantially the author's summary. The venom of a species of *Bracon* received in Hawaii from India as *B. brevicornis* Wesm., but apparently a segregate intermediate between typical *B. hebetor* Say of the western hemisphere and the typical *B. brevicornis* of Europe, did not provide any quantitative or qualitative protection to paralysed larvae of *Corcyra cephalonica* (Stnt.) against infection when spores of *Bacillus thuringiensis* var. *thuringiensis* were injected into them. Paralysed larvae were significantly more susceptible to the bacillus than unparalysed ones when kept at a constant temperature of 32°C. [89·6°F.] after treatment. Unparalysed larvae at 32°C. were as susceptible as paralysed ones at room temperature (26·2°C. [79·16°F.]), more susceptible than unparalysed ones at 26·2°C. and less susceptible than paralysed ones at 32°C. Although the venom is apparently proteinaceous in nature, the proteases of *B. thuringiensis* did not inactivate *in vivo* the venom of *Bracon*. The venom was demonstrated by bioassay 96 hours after injection with *Bacillus thuringiensis* and 72 hours after the host had died. Sterile filtrates from triturated larvae of *C. cephalonica* killed by *B. thuringiensis* caused 100 per cent. mortality in *Galleria mellonella* (L.) and *C. cephalonica* when injected into these hosts. The bacterial toxin causing mortality was slow-acting and elicited characteristic symptoms.

STEINHAUS (E. A.). **The duration of viability and infectivity of certain insect pathogens.**—*J. Insect Path.* **2** no. 3 pp. 225–229, 2 refs. New York, N.Y., 1960.

The following is virtually the author's summary. Miscellaneous observations relating to the viability, longevity and infectivity of certain insect pathogens indicated that dried spore preparations of *Bacillus thuringiensis*

var. *thuringiensis* may retain their ability to kill susceptible insects for at least 10 years. In limited feeding tests, of several varieties of crystalliferous spore-forming bacteria, *B. thuringiensis* var. *alesti* usually proved to be the most virulent for silkworm larvae (*Bombyx mori* (L.)). Conidia of three strains of *Beauveria bassiana*, dried on glass slides and kept at different temperatures, were tested for viability over a 34-month period. Conidia kept at 38 and 23°C. [100·4 and 73·4°F.] lost their viability rather rapidly (in an average of about 7 weeks), while those kept in the refrigerator at 4°C. [39·2°F.] survived as long as 128 weeks (an average of 101 weeks). Nuclear polyhedrosis virus, kept in flame-sealed glass tubes, mostly at refrigerator temperatures, was found to be still infectious for silkworm larvae after 20 years' storage.

Tanada (Y.) & Reiner (C.). **Microbial control of the artichoke plume moth, *Platyptilia carduidactyla* (Riley) (Pterophoridae, Lepidoptera).**—*J. Insect Path.* **2** no. 3 pp. 230–246, 9 refs. New York, N.Y., 1960.

The following is substantially the authors' summary. Laboratory and field tests were carried out in California on the susceptibility of the larvae of *Platyptilia carduidactyla* (Ril.), a pest of artichokes [*Cynara scolymus*], to pathogens. They proved susceptible to *Bacillus thuringiensis* var. *thuringiensis*, *Beauveria bassiana* and the nematode DD-136 [*cf. R.A.E.*, A **49** 117], but few were killed after they had entered plant tissue. In the field, only *Bacillus thuringiensis* was effective in limiting the infestation of young sprouts and developing artichokes. The effectiveness of this bacillus is dependent on its high virulence for the first-instar larva, which dies within 1–2 days after infection, usually before it can mine into the plant tissue. The study demonstrated the feasibility of using pathogens against insect pests with a low economic threshold, such as in the case of *P. carduidactyla*, in which a single larva can cause the loss of an artichoke.

Raun (E. S.), York (G. T.) & Brooks (D. L.). **Determination of *Perezia pyraustae* infection rates in larvae of the European corn borer.**—*J. Insect Path.* **2** no. 3 pp. 254–258, 4 refs. New York, N.Y., 1960.

The following is based on the authors' summary. A technique is described for counting the spores of *Perezia pyraustae* in homogenates of the larvae of *Ostrinia* (*Pyrausta*) *nubilalis* (Hb.) by means of a haemacytometer, which provided a method of determining infection rates. Previous methods depended on pathological changes in the Malpighian tubules or salivary glands, and ratings of light, medium and heavy obtained in this way corresponded to averages of about 7, 25 and 86 million spores, respectively, per larva. When fifth-instar larvae collected in the field in Iowa, Kansas, Nebraska, Wisconsin, Pennsylvania, Delaware, Minnesota and Illinois were examined by the new method, infection was found in some from each State, infection being most widespread in Delaware (66 per cent.).

Krieg (A.) & Huger (A.). **A virus disease of Coleopterous insects.**—*J. Insect Path.* **2** no. 3 pp. 274–288, 11 figs., 9 refs. New York, N.Y., 1960.

The following is virtually the authors' summary. Infection experiments and histological studies were carried out to investigate the aetiology and

pathology of the so-called dropsy (Wassersucht) that affects the larvae of *Melolontha melolontha* (L.) and *M. hippocastani* F. in Germany [*cf. R.A.E.*, A **49** 60, etc.]. Test larvae to which fat-body tissue of diseased larvae suffering from dropsy was administered perorally did not acquire the disease, whereas others injected with extracts of diseased larvae became infected and many died. With the electron microscope, virus particles 60 to 75 millimicrons in diameter were demonstrated. The principal histopathological change is localised in the adipose tissue; healthy fat-body cells of third-instar larvae contain large numbers of albuminoid spheres. In diseased larvae, however, these structures are transformed into virogenetic stroma, and thus disappear in the course of the disease. Simultaneously, the cytoplasm is replaced by a basophilic Feulgen-negative network densely packed with virus particles. From its properties, the virus was placed in the genus *Moratorvirus* and was to be named *M. lamellicornium*.

Eaves (G. N.) & Mundt (J. O.). **Distribution and characterization of streptococci from insects.**—*J. Insect Path.* **2** no. 3 pp. 289–298, 7 refs. New York, N.Y., 1960.

The following is taken from the authors' summary. Streptococci (including enterococci) were recovered from 20 of 26 species of adult insects, from pupae and larvae, and in one case from an egg, mostly taken in large agricultural fields, in Tennessee. Their random occurrence suggested that their presence resulted from accidental contact.

Sager (S. M.). **On the transtadial transmission of insect viruses.**—*J. Insect Path.* **2** no. 3 pp. 307–309, 1 fig. New York, N.Y., 1960.

Numerous laboratory observations showed that transmission from stage to stage throughout the life-cycle of the host occurred with the granulosis virus of *Peridroma saucia* Hb. (*margaritosa* (Haw.)), the nuclear polyhedrosis viruses of *Colias eurytheme* Boisd., *Bombyx mori* (L.), *Hemerocampa pseudotsugata* McDunn., *Orgyia antiqua* (L.) and *Lambdina fiscellaria* (Gn.), and the granulosis and nuclear polyhedrosis viruses of *Pseudaletia unipuncta* (Haw.).

Wittig (G.), Steinhaus (E. A.) & Dineen (J. P.). **Further studies of the cytoplasmic polyhedrosis virus of the alfalfa caterpillar.**—*J. Insect Path.* **2** no. 4 pp. 334–345, 8 figs., 2 refs. New York, N.Y., 1960.

The following is virtually the authors' summary. The polyhedra formed during the cytoplasmic polyhedrosis of *Colias eurytheme* Boisd. [*cf. R.A.E.*, A **48** 413] were soluble in boric acid and carbonate buffers at pH 10·2. Polyhedra that have been kept for several weeks tend to break up into more or less uniformly large particles, and then into smaller particles of different sizes. The purified virus itself is a small spherical particle 30 to 50 millimicrons in diameter. Ultrathin sections of the infected mid-gut show the presence, in the cytoplasm of the epithelial cells, of large numbers of free virus particles and developing polyhedral bodies. The polyhedron apparently acquires the virus by occlusion as the polyhedral protein gathers at the

periphery. Viruses sectioned within the cytoplasm or the polyhedra revealed a "core"-cortex structure, the appearance of which depended on the techniques applied.

WYLIE (H. G.). **Some factors that affect the annual cycle of the winter moth,** *Operophtera brumata* **(L.) (Lepidoptera: Geometridae) in western Europe.**—*Ent. exp. appl.* **3** no. 2 pp. 93–102, 24 refs. Amsterdam, 1960. (With a summary in French.)

The one-year life-cycle of *Operophtera brumata* (L.) in Europe varies considerably with climatic conditions, and the egg and pupal stages last two and over eight months in southern Italy [*cf. R.A.E.*, A **35** 283] and over eight and less than three months, respectively, in northern Scandinavia [*cf.* also **41** 167]. Some information on the cause of this was obtained in the course of rearing from larvae collected in western Europe and shipped to Canada soon after pupation. The following is based on the author's summary of the findings. The rate of egg development is increased by increase in temperature between at least 6 and 18°C. [42·8 and 64·4°F.], but that of pupal development is in general reduced by higher temperature. Therefore, lower temperatures in northern localities and high altitudes in Europe increase the duration of the egg stage and decrease that of the pupal stage. Inherent differences in the eggs and pupae from different localities [*cf.* **26** 420] increase these effects.

KOCH (H. A.). **Untersuchungen über die Wirkung von Insektiziden und von Pflanzenalkaloiden auf den Darmtraktus des Kartoffelkäfers und seiner Larven.** [Investigations on the effect of insecticides and plant alkaloids on the digestive tract of the potato beetle and its larvae.]—*Ent. exp. appl.* **3** no. 2 pp. 103–113, 2 pls., 25 refs. Amsterdam, 1960. (With a summary in English.)

The following is based on the author's summary of this account of investigations in eastern Germany. Larvae and adults of *Leptinotarsa decemlineata* (Say) were fed on potato leaves treated with one of three insecticides and some 80 plant alkaloids. It was found that an arsenic compound damaged the cuticle of the mid-gut and ultimately caused it to dissolve completely. Ingestion of a preparation of DDT or methyl-parathion (Wofatox) was followed by excessive secretion and the formation of a vacuole in the greatly swollen cell nucleolus. Of the plant alkaloids, physostigmine, nicotine, colchicine and veratrine were very toxic; the first two produced no noticeable histological changes, but the last two damaged the gut epithelium. Atropine formed tumours or was acutely toxic, and increased doses acted in both ways. Tomatine and various extracts of *Solanum demissum* caused few acute pathogenic changes.

EHRHARDT (P.). **Zum Sauerstoffverbrauch von** *Myzus persicae* **(Sulz.) vor und nach Aufnahme des Blattrollvirus.** [On the oxygen consumption of *M. persicae* before and after the uptake of potato leaf-roll virus.]—*Ent. exp. appl.* **3** no. 2 pp. 114–117, 12 refs. Amsterdam, 1960. (With a summary in English.)

Multiplication of the potato leaf-roll virus in *Myzus persicae* (Sulz.) was found to be accompanied by reduced oxygen consumption by the aphid.

Chiang (H. C.). **Effect of the mutilation of wings on the reproduction of the bean aphid** *Aphis fabae* **Scop.**—*Ent. exp. appl.* **3** no. 2 pp. 118–120, 1 graph, 3 refs. Amsterdam, 1960. (With a summary in German.)

The following is virtually the author's summary. Mutilation of the wings of *Aphis fabae* Scop. by pinching and twisting them immediately after the aphid emerged hastened its reproduction. The hastening was more striking among individuals so treated that were kept in the light than in those kept in the dark. Reproduction was also hastened, but to a slighter degree, among individuals with naturally deformed wings. It has been shown by earlier workers that bodily exercises hasten reproduction [*cf. R.A.E.*, A **47** 201]. The facts revealed in the present paper suggest that the nervous changes resulting from bodily exercise are more important than the actual exercises themselves.

Parr (W. J.) & Hussey (N. W.). **Further studies on the reproductive isolation of geographical strains in the** *Tetranychus telarius* **complex.**—*Ent. exp. appl.* **3** no. 2 pp. 137–141, 8 refs. Amsterdam, 1960. (With a summary in German.)

It has recently been suggested that mites of the complex of *Tetranychus telarius* (L.) represent several distinct species and subspecies, which, though morphologically indistinguishable, will not hybridise [*cf. R.A.E.*, A **48** 252, etc.]. They comprise two main groups, those having carmine or reddish-brown summer females and those with green summer females; the males are indistinguishable by colour, varying from straw yellow to pale green. Boudreaux found that hybrid females produced by crossing North American carmine and green forms were sterile or produced only male progeny, and he retained the name *T. telarius* for the green form and considered the carmine one to be *T. cinnabarinus* (Boisd.) [**46** 261]. The authors obtained similar results in cross-breeding tests with the reddish-brown and green forms occurring in glasshouses in Britain [**47** 174], and since Boudreaux, in a further paper [**47** 155], showed that there is no true diapause in *T. cinnabarinus*, they now consider the British reddish-brown form to belong to that species.

In further work in Britain, attempts were made to cross the British green form with the Massachusetts and Cranbury green forms from the United States, and the British red form with the Beltsville red form [*cf.* **46** 57]. The British forms had been bred in isolation for many generations. Numerous reciprocal crosses were made, and no difficulty was experienced in obtaining eggs of the F_1 generation. Crosses between the green forms resulted in F_1 hybrid females, but, though these were fully fertile, they were less numerous than the males, which indicated some reproductive incompatibility; the numbers of eggs laid were low. The crosses between the red forms produced F_1 hybrid females that were either sterile or of very low fertility.

These results are discussed in the light of further unpublished work by Boudreaux, and it is concluded that the green and red colour groups represent distinct species (*T. telarius* (*urticae* Koch) and *T. cinnabarinus*, respectively), though each is polytypic. The British forms used are normally inhabitants of glasshouses, and it is noted, in view of the observations of van de Bund & Helle [*cf.* next abstract], that the authors' *T. cinnabarinus* has become naturally established on tomatos and cucumbers as well as on the perennial glasshouse crops, such as carnations and arum lilies, with which it is most usually associated.

VAN DE BUND (C. F.) & HELLE (W.). **Investigations on the *Tetranychus urticae* complex in north west Europe (Acari: Tetranychidae).**—*Ent. exp. appl.* **3** no. 2 pp. 142–156, 2 pls. (1 col.), 7 figs., 20 refs. Amsterdam, 1960. (With a summary in German.)

Mites of the complex of *Tetranychus telarius* (L.) (*urticae* Koch) in glasshouses in Holland are of two easily distinguished types, one having green summer females and the other carmine ones. Characters differentiating them in the two sexes are described, and it is concluded that they are referable to *T. telarius* and *T. cinnabarinus* (Boisd.), respectively.

In a study of their food-plant relations, adult females of *T. cinnabarinus* from carnations and *T. telarius* from glasshouse roses, French beans, *Chelidonium majus*, *Euonymus europaeus*, *Rosa canina* (wild rose), *Sambucus nigra* (elder), *Althaea rosea* (hollyhock) and *Urtica dioica* (nettle) were transferred to leaves of carnation, rose, bean, *Sambucus*, *Urtica*, *Althaea*, *Chelidonium* and *Euonymus*. Eggs were deposited in all cases, and an F_1 generation was reared. Further breeding showed that two groups could be distinguished, according to the plants on which the F_1 generation reproduced. One of them consisted of *T. cinnabarinus*, which developed normally on all the experimental plants, and the other consisted of *T. telarius* which developed on all except carnation. In further tests, the numbers of eggs laid on bean and carnation did not differ significantly for *T. cinnabarinus*, but were significantly lower on carnation than on bean for *T. telarius*; the numbers of eggs laid by the two species on bean did not differ significantly. Populations of *T. cinnabarinus* show variability in morphology, especially in the form of the aedeagus. When two strains differing in this respect were reared separately on carnations and beans at three temperatures, the developmental periods were the same for both strains but shorter on bean than on carnation. Mortality of *T. cinnabarinus* was low on either plant, and that of *T. telarius* high on carnation and low on bean. It is concluded that decreased egg production and high mortality of the newly hatched mites render carnation an unsuitable food-plant for *T. telarius*, and that bean is more favourable than carnation for *T. cinnabarinus*.

Field observations indicate that there is a difference between the two species in mode of hibernation. In autumn, the adult female of *T. telarius* changes from green to orange and the side spots disappear. The orange females neither feed nor oviposit, but hibernate in small clusters on dry stalks, in the bark of trees, under dead leaves or in the soil, often covered with webbing. *T. cinnabarinus* likewise changes from carmine to orange, but there is no diapause [*cf.* preceding abstract], and the females resume their original colour and feed and oviposit if restored to favourable conditions; even in mid-winter, they remain on the leaves of their food-plants. In a test in which the mites were reared at five temperatures ranging from 22·5 to 12·5°C. [72·5 to 54·5°F.] and a daily photoperiod of 7 hours and the adult females were transferred to fresh leaves at 25°C. [77°F.] after different periods, *T. telarius* entered diapause at the lower temperatures, but *T. cinnabarinus* did not. Exposure to various low temperatures showed that the diapause form of *T. telarius* was resistant to cold, survival being almost complete after 56 days at −5°C. [23°F.] and complete after five days at −22°C. [7·6°F.], whereas the winter form of *T. cinnabarinus* was not, 12 and 0 per cent. surviving these two treatments, respectively. The susceptibility of *T. cinnabarinus* explains its absence in the field in spring, although it is present in autumn.

In reciprocal crossing experiments, in which the criteria were mating of the parents, fertility of the F_1 generation and the development of an F_2 generation, strains of *T. telarius* from all the plants previously used proved

fully fertile, and Dutch strains from different plants were also crossed successfully with *T. telarius* from Switzerland (Basle) and Germany (Bentheim). The two populations of *T. cinnabarinus* were also interfertile, and one of them was crossed successfully with strains of this species from three places in Germany and one in Belgium. When the same strain of *T. cinnabarinus* was crossed with seven Dutch strains of *T. telarius*, however, though eggs were laid in all cases, four of the 35 crosses resulted in a small fertile hybrid generation and a few mites of the F_2 generation, all of which were sterile, and the remainder in hybrids that did not oviposit or laid only sterile eggs, thus confirming that *T. cinnabarinus* is specifically distinct [*cf.* preceding abstract, etc.].

Deseö (V. K.). **Beobachtungen über Luzerneschädlinge mit besonderer Berücksichtigung des *Aphrodes bicinctus* Schrk. (Homopt.), *Apion tenue* Kirby und *Subcoccinella vigintiquatuorpunctata* L. (Coleopt.).** [Observations on lucerne pests with special reference to *Aphrodes bicinctus*, *Apion tenue* and *S. vigintiquatuorpunctata*.]—*Anz. Schädlingsk.* **32** pt. 7 pp. 97–99, 3 figs., 3 refs. Berlin, 1959.

Observations in Hungary showed that the Cicadid, *Aphrodes bicinctus* (Schr.), which normally causes little damage to lucerne, became injurious in 1958, when the spring was warm and dry; it attacked the buds, young leaves (which were malformed as a result) and flowers (which withered and fell). In addition, *Apion tenue* Kby. fed on the leaves and shoots, and *Subcoccinella vigintiquatuorpunctata* (L.) occasionally caused considerable damage, the larvae and adults feeding on the leaves and the adults destroying the buds.

Heinze (K.). **Versuche über die Haltbarkeit des Enationenvirus der Erbse (scharfes Adernmosaik) in der Erbsenblattlaus (*Acyrthosiphon onobrychis* (B. d. F.)).** [Tests on the persistence of the pea enation virus (acute vein mosaic) in *Macrosiphum pisum*.]—*Anz. Schädlingsk.* **32** pt. 8 pp. 123–124, 4 refs. Berlin, 1959. (With a summary in English.)

In tests in Germany on the persistence of the pea enation mosaic virus in its vector, *Macrosiphum pisum* (Harris) (*Acyrthosiphon onobrychis* (Boy.)) [*cf. R.A.E.*, A **39** 46], aphids fed for three days on infected material, and then transferred singly to uninfected plants each day until death, transmitted the virus for a maximum of 19 days and to a maximum of 16 plants. Further observations showed that the minimum periods for acquisition and transmission of the virus were one hour [*cf.* **47** 19], and continuous feeding on infected and then healthy material for 16–24 hours produced almost 100 per cent. infection. When infected aphids were kept on healthy plants for more than four days at 31·5°C. [88·7°F.], or for more than five days at −6°C. [21·2°F.], and then transferred to healthy plants at 20–26°C. [68–78·8°F.], no symptoms appeared on the latter. Further tests showed that nymphs were more effective vectors than adults.

Acatay (A.). **Pappelschädlinge in der Türkei.** [Poplar pests in Turkey.]—*Anz. Schädlingsk.* **32** pt. 9 pp. 129–134, 6 figs., 11 refs. Berlin, 1959.

A list is given of the various insects and mites that infest poplar (*Populus* spp.) in Turkey, with notes on their bionomics, distribution, importance and natural enemies.

Laubmann (M.). **Der Einfluss von Länge, Breite und Materialbeschaffenheit von Spalten auf die Eiablage des Getreidekapuziners,** *Rhizopertha dominica* **Fab.** [The influence of the length, breadth and material structure of crevices on oviposition by *R. dominica*.]—*Anz. Schädlingsk.* **32** pt. 11 pp. 161–166, 1 fig., 22 refs. Berlin, 1959.

A detailed account is given of laboratory tests carried out to determine the type of oviposition site preferred by females of *Rhyzopertha dominica* (F.). Preliminary tests showed that more eggs were laid on maize than on other grains and that this was probably due to the fact that maize seeds were not only the largest used but also the only ones having prominent glumes, which provide the crevices favourable for oviposition. On wheat seeds, most eggs were laid in the raphe, which was the part of the grain affording the deepest crevices.

In most of the remaining tests, wheat was supplied as food, and artificial crevices were provided for oviposition. These were usually 2 cm. long and were formed by placing two superimposed pieces of paper or polyethylene of the desired thickness, the upper one slightly overlapping the lower, against the bottom or side of the dish, the crevice in the latter case facing upwards (vertical crevice). Some of the vertical crevices were situated beneath, or near the surface of, a deeper, 3-cm. layer of grain. The following is based mainly on the author's summary of the results. In the case of the 2-cm. horizontal crevices formed with paper, the percentage of eggs laid in them was greatest (48) when the height of the crevice was 0·03 mm. Considerably fewer eggs were laid in vertical crevices or those made of polyethylene. More eggs were laid in horizontal paper crevices 0·02–0·14 mm. in height than were laid in the raphe of the grain provided, which appears to contradict the view that the oviposition site chosen is one favourable for larval development [*cf. R.A.E.*, A **32** 315]. In general, more eggs were laid in one 2-cm. crevice than in two 1-cm. ones. Some eggs were inserted between the two pieces of paper from which the crevice was formed, and the proportion inserted between two pairs of papers 1 cm. square was greater than that between one pair 2 cm. square. Fewer eggs were laid in 2-cm. vertical crevices beneath the grain than near its surface.

In tests in which the beetles were provided with wheat seeds in which holes of various diameters had been bored (elsewhere than in the raphe), many more eggs were laid in holes 0·22–0·7 mm. in diameter and fewer in holes 0·18 mm. in diameter than were laid in the raphe.

Schefer-Immel (V.). **Einige Bemerkungen zur Biologie des Pappeltriebwicklers,** *Semasia aceriana* **Dup.** [Some observations on the bionomics of *Gypsonoma accriana*.]—*Anz. Schädlingsk.* **32** pt. 11 pp. 166–169, 6 figs., 16 refs. Berlin, 1959.

Outbreaks of the Tortricid, *Gypsonoma* (*Semasia*) *aceriana* (Dup.), occurred on poplars (*Populus* spp.) in the Harz, Hanover and Rhine-Main areas of Germany in 1958–59, following an increase in population over several years. Observations on its bionomics [*cf. R.A.E.*, A **46** 284] showed that trees of all ages above 1–2 years were attacked. The overwintered larvae mined in the buds and shoots from the beginning of April and pupated in the soil in June. The adults emerged from about 10th July and oviposited on the leaves, and the larvae mined in the latter until about 10th October and then overwintered in the buds.

Sol (R.) & Sanders (W.). **Über die Empfindlichkeit von Syrphidenlarven gegen Pflanzenschutzmittel.** [On the susceptibility of Syrphid larvae to materials for plant protection.]—*Anz. Schädlingsk.* **32** pt. 11 pp. 169–172, 1 graph, 5 refs. Berlin, 1959.

Field beans [*Vicia faba*] growing in pots were infested with *Aphis fabae* Scop. and later with Syrphid larvae (mainly *Syrphus* (*Epistrophe*) *balteatus* (Deg.)). After some time, the plants were sprayed with insecticides to assess the effect of these on the predators. The results showed that many insecticides gave high mortality of older larvae and that younger ones were even more susceptible. Phosphorus compounds appeared on the whole more harmful than chlorinated hydrocarbons. Methyl-demeton (Metasystox) was very toxic as a spray, but much less so when it was applied to the roots or lower plant parts so as to act systemically.

Tannert (W.). **Ein seltener Schadfall der Lebensmittelhygiene: Collembolen an Butter.** [A rare case of infestation of foodstuffs: Collembola in butter.]—*Z. angew. Zool.* **47** pt. 1 pp. 91–93, 3 refs. Berlin, 1960. (With a summary in English.)

Hypogastrura distincta (Axelson), which was previously known only from Finland, was found in June 1958 in packets of butter in Berlin. All the insects were dead.

Tannert (W.). **Der Kornkäfer als Wohnungslästling.** [The grain weevil as a domestic pest.]—*Z. angew. Zool.* **47** pt. 1 pp. 95–97, 4 refs. Berlin, 1960. (With a summary in English.)

Sitophilus (*Calandra*) *granarius* (L.) caused annoyance in a house near Berlin by migrating in numbers from the cellar, where it was developing in grain, to the rooms above.

Alkan (B.). **Haselnussschädlinge in der Türkei.** [Pests of hazel-nuts in Turkey.]—*Z. angew. Ent.* **44** pt. 2 pp. 187–202, 7 figs., 18 refs. Hamburg, 1959. (With a summary in English.)

Hazel-nuts (*Corylus avellana*) constitute one of the main exports of Turkey, most of them being produced on the Black Sea coast. An account is given of the bionomics and importance of the numerous insect and other pests affecting the crop, with notes on their control, and the more important are noticed below.

The Eriophyid, *Phytoptus* (*Eriophyes*) *avellanae* Nal., is fairly common in most districts and causes galling of the buds. On the Black Sea coast, the mites leave the galls at the end of September or beginning of October and again in March–May, and seek fresh, young buds in the vicinity. Several hundred sometimes develop in a single gall. The number of generations per year is not known, but up to 30 per cent. of the buds are destroyed in many years. Applications of sulphur dust at a rate of 36 lb. per acre during the movement of *P. avellanae* in the spring afford control.

Curculio (*Balaninus*) *nucum* L. is the most important of the insect pests.

destroying an average of 10 per cent. of the nuts each year. Plantations facing north at altitudes of 500–1,300 ft. are those most seriously affected. The adults appear in April–May and feed, before reaching sexual maturity, on the flowers, nuts, leaves and young shoots. As a result, the shoots wither and fungi attack the nuts. Pairing occurs in early June, and the females oviposit in the still soft nuts a week later, laying an average of 42 eggs each at a rate of 1, or rarely 2, per nut. The larvae hatch in 8 days, complete their development in about 29 days and enter the soil to overwinter towards the end of July. They cause somewhat less damage than the adults, attacked nuts attaining their normal size although falling prematurely. Pupation occurs in the spring, the pupal stage lasting 9 days, but some of the resulting adults remain in the soil for one or two years before becoming active [*cf. R.A.E.*, A **39** 229]. The application of dusts effective against the adults was begun in 1953, and some 44,000 acres were treated in 1956. Those used were mainly mixtures of γ BHC and DDT (with or without sulphur). Of the other Coleoptera that attack the bushes, adults of *Anoplus plantaris* (Naez.), which was observed for the first time in 1952, feed on the flower stems, young leaves and shoots in spring, larvae of *Oberea linearis* (L.) bore beneath the bark of young shoots, the larvae of various Lamellicorns, including *Melolontha melolontha* (L.) and *Polyphylla fullo* (L.), cause considerable damage to the roots, and the Scolytid, *Xyleborus* (*Anisandrus*) *dispar* (F.) attacks mainly, but not exclusively, physiologically weakened bushes.

The Lepidoptera include *Lymantria dispar* (L.) which is widely distributed and defoliates the bushes, and *Gypsonoma dealbana* (Froel.). Larvae of this Tortricid overwinter in the galls of *Phytoptus avellanae* and destroy the young leaf-buds in spring. Later, they move to the shoots and leaves. They pupate in the rolled leaves, and the adults emerge in June. Eggs are laid on the lower surfaces of the leaves, and the larvae feed a little before overwintering, there being only one generation a year. Good control is obtained by spraying with 1·5 per cent. lead arsenate or 0·15 per cent. DDT when the larvae leave their winter quarters.

The stored nuts are infested by various insects, including *Plodia interpunctella* (Hb.), *Anagasta* (*Ephestia*) *kühniella* (Zell.) and *E. elutella* (Hb.), which are common, *Cadra* (*E.*) *cautella* (Wlk.), which is uncommon, and *Aphomia gularis* (Zell.), which is rare and was recorded for the first time in Turkey in 1954.

Zech (E.). **Beitrag zur Kenntnis einiger in Mitteldeutschland aufgetretener Parasiten des Apfelwicklers** (*Carpocapsa pomonella* **L.).** [Contribution to knowledge of certain parasites of *Cydia pomonella* occurring in central Germany.]—*Z. angew. Ent.* **44** pt. 2 pp. 203–220, 8 graphs, 34 refs. Hamburg, 1959. (With a summary in English.)

During investigations at Naumburg, central Germany, in 1953–55 on *Cydia* (*Carpocapsa*) *pomonella* (L.) infesting apple and pear, larvae were collected at intervals from trap-bands and kept in the laboratory for emergence of parasites. The primary parasites reared comprised two Ichneumonids, *Trichomma enecator* (Rossi) and *Pristomerus vulnerator* (Panz.), a Braconid, *Ascogaster quadridentata* Wesm., and a Tachinid, *Elodia* (*Arrhinomyia*) *tragica* (Mg.). *Perilampus tristis* Mayr, which is known to parasitise *Ascogaster quadridentata* [*R.A.E.*, A **30** 111] and *Pristomerus vulnerator*, was also obtained. Parasitism of *C. pomonella* amounted to 8.4 per cent. in 1953 and 16·3 per cent. in 1954, and *P. vulnerator* was the most important parasite. The literature on the occurrence of these species as parasites of

C. pomonella in Germany and other countries is reviewed, their alternative hosts are listed, and details are given of their seasonal frequency, emergence dates and sometimes other bionomics.

Lyngnes (R.). **Beitrag zur Biologie des Anobienparasiten** *Trigonoderus tristis* **Walk. (Hym. Chal.).** [Contribution to the bionomics of the *Anobium* parasite, *T. tristis*.]—*Z. angew. Ent.* **44** pt. 2 pp. 221–225, 5 figs. Hamburg, 1959. (With a summary in English.)

Further observations on *Trigonoderus tristis* Wlk., a Cleonymid parasite of *Anobium punctatum* (Deg.) infesting wood in buildings at Sunnmöre, in western Norway [*cf. R.A.E.*, A **46** 463], showed that it attacks the pupae of *A. punctatum* in their chambers or in some cases larvae that have come to the surface of the wood, one egg being laid in each. The adults emerge in May in warm places, but several weeks later in cooler ones. The ovipositor of the female is described. Development lasted rather less than a year when the summer was warm and about a year when it was cooler. Wind-free, damp and particularly coastal situations appeared to favour the parasite, and in counts of living or dead adult insects found on two roof windows, one in a stone house and the other in a wooden one, on the coast of one of the off-shore islands on 28th August 1957, five individuals of *A. punctatum*, 13 of *Spathius exarator* (L.) [*cf. loc. cit.*] and 35 of *T. tristis* were taken in the stone house and 36, 632 and 244, respectively, in the other, indicating a degree of parasitism that would render chemical intervention undesirable.

Hemer (M.). **Zur Biologie, wirtschaftlichen Bedeutung und Bekämpfung der Fritfliege** (*Oscinis frit* **L.) an Gerste. I. Teil.** [On the bionomics, economic importance and control of *Oscinella frit* on barley. Part I.]—*Z. angew. Ent.* **44** pt. 3 pp. 314–339, 13 figs. Hamburg, 1959. (With a summary in English.)

Since less is known about the control of *Oscinella* (*Oscinis*) *frit* (L.) on barley than on oats, investigations were carried out near Herford, in western Germany. The seasonal occurrence of the fly was studied by net-catches in grassland in 1948–52, and the results are here recorded, together with the weather conditions in each season. There were three generations a year [*cf. R.A.E.*, A **24** 486]. Adults of the overwintered generation were present from late April or early May to late June or early July, those of the first generation from about the latter dates to mid-August or early September, and those of the second from then until October. Weather had a considerable effect on flight. Activity was greatest at 20–25°C. [68–77°F.], but was impeded by wind and even slight precipitation. Cloud and atmospheric pressure were of less importance. The sequence of generations was to some extent related to phenological data of various plants [*cf. loc. cit.*] and the appearance of adults in spring was shown in observations in several localities with differing climatic conditions to be even more closely correlated with such data. Observations on oviposition sites and larval behaviour are described. Oviposition occurred less on young barley than on young oats, and light attack on the stems was largely counteracted by the production of new shoots if the plant was not too young, but attack on the ears was as severe on barley as on oats. Late varieties and stands were more damaged than early ones, and the larvae completed their development more rapidly in the ears than in the stems.

Lemarie (J.). **Beitrag zur Kenntnis der Bionomie von** *Exoteleia dodecella* **L. (Lepidoptera: Gelechiidae).** [Contribution to knowledge of *E. dodecella*.]—*Beitr. Ent.* **9** no. 7–8 pp. 800–804, 1 fig., 13 refs. Berlin, 1959. (With summaries in English & Russian.)

The following is almost entirely based on the author's summary of this account of investigations carried out in southern Moravia in 1954–58 on *Exoteleia dodecella* (L.), which had become numerous on pines. The adults emerged mainly from mid-June to the second half of July, and eggs were laid chiefly on or just below the base of the needles. The larvae hatched in about 10–14 days and mined at first in the same needles and then, from the end of September, moved to others, in which they hibernated. In the spring, they attacked still other needles for about a week and then the buds, in which they formed cocoons. The pupal stage lasted 10–14 days. Mass increase was checked in all places by parasites.

Wilbert (H.). *Apanteles glomeratus* **(L.) als Parasit von** *Aporia crataegi* **(L.) (Hymenoptera: Braconidae).** [*Apanteles glomeratus* as a parasite of *Aporia crataegi*.]—*Beitr. Ent.* **9** no. 7–8 pp. 874–898, 56 refs. Berlin, 1959. (With summaries in English & Russian.)

Investigations on parasitism of *Aporia crataegi* (L.) by *Apanteles glomeratus* (L.) were carried out in 1955–56 during an outbreak of the Pierid on fruit trees in the Rhineland. The following is based mainly on the author's summary of the results. The parasite larvae emerged from the fully fed, overwintered larvae of *Aporia* (which has one generation a year) in spring and spun cocoons. The adults emerged in the second half of May, and the first generation probably developed in *Pieris brassicae* (L.), since the adult parasites lived for only 1–2 weeks in the laboratory and larvae of *Aporia* were not present until the beginning of July and were not attacked until some time later. The timing of oviposition depended less on the age of the host larvae than on the date of emergence of the parasites, although first-instar larvae were preferred. Parasitism reached a maximum of about 20–30 per cent. in the autumn of 1955 in the centre of the infested area, but was 60–80 per cent. in 1956. Some 60–75 per cent. of the *Apanteles* cocoons failed to give rise to adults, mainly owing to parasitism. It is concluded that, although *Apanteles* checks the population of *Aporia* in normal years, its effectiveness during an outbreak is limited by its dependence on an intermediate host.

Müller (F. P.). **Bionomische Rassen der Grünen Pfirsichblattlaus** *Myzus persicae* **(Sulz.).** [Biological races of *M. persicae*.]—*Arch. Fr. Naturgesch. Mecklenburg* **4** pp. 200–232, 2 figs., 44 refs. Rostock, 1958. (With a summary in English.)

The following is based on the author's summary. Various strains of *Myzus persicae* (Sulz.) have been under observation in Germany since 1953, and their behaviour indicated that the species should be considered to comprise a number of biological races. Tobacco, which is heavily infested in tropical countries and damaged to some extent in Germany in summer, was an unsuitable food-plant for most of them, but one race, which resembled the tropical form in various ways, was reared on it with success. Cabbage is frequently infested in western Germany, but much less so in eastern Germany, and this is attributed to the occurrence in the west of a race able to reproduce parthenogenetically outdoors in winter in a maritime climate.

Other races reproduce holocyclically, but a strain with green apterae never produced sexual forms. Strains reproducing in both ways were observed on potato.

Ohnesorge (B.). **Die Massenvermehrung der Sitkalaus in Nordwestdeutschland.** [The outbreak of the Sitka-spruce aphid in north-western Germany.]—*Forstarchiv* **30** pt. 4–5 pp. 73–78, 2 figs., 14 refs. Hanover, 1959.

A severe outbreak of *Rhopalosiphum* (*Liosomaphis*) *abietinum* (Wlk.), which was not previously known as a pest in Germany, occurred on Sitka spruce [*Picea sitchensis*] in north-western districts in the spring and summer of 1957 [*cf. R.A.E.*, A **49** 45]; whole stands of this tree were destroyed, and other spruces were also infested. The nomenclature of *R. abietinum* is discussed, the alate and apterous virginoparae and the oviparae, which were observed only in the laboratory, are described, the extent of the outbreak is shown on a map, and observations on the bionomics, ecology and natural enemies of the aphid are recorded. Older trees were the most affected, and old needles were preferred; infestation was heaviest in coastal districts. It is thought unlikely that the damage was due solely to loss of sap, and some toxic effect of the saliva is considered possible [*cf.* **20** 377]. Development of the apterae was completed in an average of 18 days at 16°C. [60·8°F.] and reproduction began three days later, but fecundity was low (averaging 12 nymphs per female). The principal natural enemies were Coccinellids and Syrphid larvae; a disease, possibly of fungous origin, was also observed. The collapse of the outbreak is attributed to overpopulation (and consequent starvation) and the disease.

Petersen (B. B.). **Sitkalusen.** [The Sitka-spruce aphid.]—*Dansk Skovforen. Tidsskr.* **45** pp. 511–526, 3 figs., 19 refs. Copenhagen, 1960. (With a summary in English.)

Rhopalosiphum (*Neomyzaphis*) *abietinum* (Wlk.) was very common on spruce in Denmark in 1957, as in other parts of north-western Europe [*cf.* preceding abstract], and to a less extent in 1959. The appearance, foodplants, distribution, bionomics, natural enemies and control of this aphid are reviewed. It overwinters as apterous viviparae, and examination of records for 1925–59 showed that outbreaks follow mild winters, which suggests that there is no winter diapause. This observation allowed the outbreak in 1959 to be foreseen early enough for control measures to be instituted, and a spray of methyl-demeton (Metasystox), applied in May, proved very effective. Damage was most severe on *Picea sitchensis* and *P. glauca*.

Dahl (J.) & Petersen (B. B.). **Om virkningen af kemisk skadedyrbekaempelse på insekter og spindler i en granskov.** [On the influence of chemical control on the arthropod fauna of a spruce forest.]—*Forstl. Forsøgsv. Danm.* **26** pp. 273–312, 11 figs., 4 refs. Copenhagen, 1960. (With a summary in English.)

The following is based on the authors' summary. Insecticides were applied in a spruce forest in southern Denmark for the control of *Pristiphora* (*Lygaeonematus*) *abietina* (Christ) in 1950, 1951, 1955 and 1956 [*cf. R.A.E.*, A **47** 107, etc.], and observations are here recorded on their effect on the rest of the arthropod fauna. Quassia sprays had little effect, but the other materials,

and especially parathion, were highly toxic. Nevertheless, numbers seemed to recover after a few days, and it seems unlikely that any species would be eliminated by such treatments.

Balevski (A. D.), Vasev (A. N.), Ivanov (S. Kh.), Lazarov (A. V.) & Tsvetkova (Ts. T.). **The codling moth** (*Laspeyresia pomonella* **L.), bionomics, ecology, control measures and possibilities for the introduction of a warning service.** [*In Bulgarian.*]—*Nauch. Trud. Minist. Zemed. nauch. Inst. Zasht. Rast.* **1** pp. 105–158, 2 graphs, 31 refs. Sofia, 1958. (With summaries in Russian & German.)

Cydia (*Laspeyresia*) *pomonella* (L.), all stages of which are described, is by far the most important pest of apples in Bulgaria. In this paper, an account is given of the first large-scale investigations on its bionomics, ecology and control there, carried out in 1951–57. In addition to apples, related fruits, stone fruits and walnuts were also infested.

There were two generations a year, of which the second was much the more injurious. The adults of the overwintered generation emerged 6–15 days after flowering of apple trees had ended, and they survived for 8–12 and occasionally up to 18 days. Pairing and oviposition occurred 1–3 and 2–7 days after emergence, respectively, oviposition beginning when the average daily temperature rose to 16·8°C. [62·2°F.], and the eggs were deposited on the leaves and sometimes on the fruits and branches. The numbers of eggs laid per female ranged up to 162 and averaged 42. The eggs hatched in 14–15, 11–12, 10–11 and 7–8 days at 14·7–15·5, 16–17, 18·3–19·4 and 20·8–21·3°C. [58·5–59·9, 60·8–62·6, 64·9–66·9 and 69·4–70·3°F.], respectively. The larvae spent a few hours on the leaves and then entered the fruits, mainly at the points of contact with leaves, other fruits or branches. Only 3–10 per cent. of the larvae entered apples through the calyx, so that a calyx spray is unnecessary in Bulgaria. At 23°C. [73·4°F.], the larvae required 25–45 days from entering the fruit to the formation of the cocoon. There was usually only one larva per fruit, but each larva injured 1–3 fruits. Pupation usually took place 2–5 days after cocoon formation, but 0·5–12 per cent., and in some years and places up to 75 per cent., of the larvae entered diapause and overwintered. The pupal stage lasted 5–20 days, usually 8–12, and emergence of the first-generation adults began in the first half of July; mass emergence occurred from mid-July to about 22nd August. The behaviour of the adults was similar to that of the overwintered generation, but the higher temperatures reduced the oviposition period and the total length of life. The second-generation larvae hatched in 6–8 days and fed for 18–36 days before overwintering. Many of them did not complete their feeding before harvest and were thus transported with the fruit into the storehouses. The overwintered larvae pupated in spring after the average daily temperature had exceeded 10·5°C. [50·9°F.] for some days, and the pupal stage lasted 15–50 days.

Parasites reared from the larvae and pupae included *Elodia morio* (Fall.), *Pimpla turionellae* (L.), *Ephialtes punctulatus* (Ratz.) (*extensor* Tasch.), *Ascogaster rufipes* (Latr.) and *A. quadridentata* Wesm. and these stages were also attacked by five predators, which are listed. In 1955, an unusually wet year, a wilt disease caused high mortality of the larvae.

In field-cage tests of insecticides, sprays of 0·4 per cent. DDT or 0·05 per cent. parathion gave complete kill of adults for six days after application, and DDT remained effective for 12 days if formulated with oil emulsion; both compounds are stated to have given good control of the eggs. Against the larvae, 0·5 per cent. lead arsenate and the DDT and parathion sprays were

very effective, giving good control for 7–12 days, and 0·05 per cent. methyl-parathion (Wofatox) was as good or better. Field tests were carried out in various places and on various varieties of apple, and the results, which are given in detail in tables, showed that the greatest reductions in infestation were given by lead arsenate, DDT and parathion. Three applications against each generation are recommended, or two if infestation is light. Observations indicated that DDT and parathion were more effective on varieties having fruits with a high content of lipophilic substances in the skin.

Spraying should be begun at the time of hatching of the first larvae. In attempts to forecast the correct date, poor results were given by using the sum of effective temperatures, but observations on the emergence of adults in spring from trap-bands in which the overwintering larvae had spun their cocoons proved satisfactory and it was found that the beginning of hatching coincided with the beginning of mass emergence of the adults. Forecasting should be carried out by central organisations, and it is recommended that sprays of DDT or parathion should be supplemented by the use of trap-bands treated with parathion, which eliminate 30–45 per cent. of the larvae on the trees.

Kaĭtazov (A.). *Capnodis tenebrionis* **L. Bionomics and measure for control.** [*In Bulgarian.*]—*Nauch. Trud. Minist. Zemed. nauch. Inst. Zasht. Rast.* **1** pp. 159–187, 6 figs., 15 refs. Sofia, 1958. (With summaries in Russian & English.)

Capnodis tenebrionis (L.) is an important pest of stone fruit trees in Bulgaria, and an account is given of investigations on its bionomics and control in 1951–55, during which period it greatly increased in numbers, killing over 40,000 trees in one district. All stages of the Buprestid are described, and its food-plants are listed. The life-cycle lasted two years. Eggs laid in June–July gave rise to adults in July–August of the succeeding year; the adults overwintered and died in the following summer. Eggs laid in late August and September gave rise to adults in September–October of the following year or in April–May of the one after. Adults appeared in the field at two main periods, in spring and in July–August, and winter was passed both by the larvae, in the roots of infested trees, or by the adults, in the pupal chambers or in cracks in the soil or under fallen leaves. The adults first appeared in March–April, and were active until November. Pairing occurred during June and July, and oviposition began when the daily mean temperature was 28–33°C. [82·4–91·4°F.], which occurred in July and August. The eggs were laid on the root collar or on the soil near the trees, and up to 776 were produced per female in the laboratory. The eggs hatched in 7–37 days, and the larvae, which could survive for 36 hours without food, entered the roots and mined in the cambium. The larval stage lasted 12 months, and the pupal stage 23–37 days.

Laboratory tests with 18 insecticides, including several proprietary preparations of unspecified composition, followed by field experiments with the most effective of them, showed that sprays of 1, 1·5 or 2 per cent. toxaphene and 0·2 per cent. parathion were very effective against the adults when applied at intervals of 25 days between 1st June and 25th August. The former gave complete kill for 25–29 days and the latter for 12 days. Tests against the larvae showed that nursery stock could be protected from mass infestation by dipping the roots of the young trees in a slurry of soil, stable manure and 12 per cent. BHC in a ratio of 70:27:3. Trees treated in this way showed only 4 per cent. infestation after two years, as compared with nearly 60 per cent. for untreated ones. Treating the soil to a depth of 2–4 in. round the root collar of established trees with BHC at 1·8–2·7 lb. per acre gave good control

of the larvae in the roots, and fumigation for 24–72 hours with carbon bisulphide controlled them in nursery stock at temperatures above 12°C. [53·6°F.]. For fumigation, the young trees were arranged in a row with their roots lightly covered with soil in a trench, and carbon bisulphide at a rate of 2·5–4 oz. per yd. in sawdust was scattered over this and covered with a further layer of soil. Painting the base of the trunks up to a height of 4–6 in. with parathion, BHC, p-dichlorobenzene or lime is also recommended against both adults and larvae.

STANEV (M. Ts.). *Acanthoscelides obsoletus* **Say and** *Callosobruchus quadrimaculatus* **F. as pests of leguminous seed crops in Bulgaria and their control.** [*In Bulgarian.*]—*Nauch. Trud. Minist. Zemed. nauch. Inst. Zasht. Rast.* **1** pp. 189–257, 8 figs., 74 refs. Sofia, 1958. (With summaries in Russian & German.)

Acanthoscelides obtectus (Say) (*obsoletus*, auct.) and *Callosobruchus maculatus* (F.) (*quadrimaculatus* (F.)) were observed in Bulgaria for the first time in 1948. The former, which attacks *Phaseolus* beans of several species and occasionally broad beans (*Vicia faba*), has become an important pest of *P. vulgaris* in the south, whereas the latter, which infests *P. aureus* (*radiatus*) and chick pea (*Cicer arietinum*), is of little importance, since these are less widely grown. All stages of the Bruchids are described, their world distribution, food-ranges and synonymy are reviewed, and detailed accounts are given of investigations on their bionomics and control carried out in 1949–52.

A. obtectus had 4–5 generations a year and infested dried beans in store at all seasons and beans in the field as soon as they became mature, eggs being laid from mid-July to the end of August through cracks or slits gnawed in the pods. The eggs hatched in 8–10 days in July, at a mean temperature of 25·8°C. [78·4°F.] and relative humidity of 60 per cent. Laboratory tests showed that the optimum temperature for egg development was about 25–31°C. [77–87·8°F.], the duration of the stage ranging from 6–7 days in July–August to 12–13 days in April and 16–22 in November. The duration of the larval and pupal stages was also dependent on temperature; the former lasted 34–42 days in April–May and 22–32 days in July–August in the laboratory and 105–132 days in storehouses at 10–18·5°C. [50–65·3°F.], and the latter varied from 4–5 to 22–28 days in the laboratory at temperatures ranging from about 30 to 14°C. [86 to 57·2°F.]; the results of observations at constant temperatures are recorded. Winter was passed only in the larval stage, in beans stored indoors or under shelters in the open. Adults of the overwintered generation emerged in April. Under laboratory conditions, those of subsequent generations emerged in June, July, August and October–November, but the number of generations may be increased under warm storage conditions.

The habits of *Callosobruchus maculatus* were similar, but it had five generations and a partial sixth in the year under laboratory conditions, though only four in storehouses. Eggs were laid only on mature beans, and attack in the field began as soon as they were ripe. The optimum temperature for egg development was the same as for *A. obtectus*, and the egg stage lasted 9–11 days in July. In the laboratory, the duration of complete development ranged from 114–150 days at about 16°C. [60·8°F.] to 22–28 days at about 31–32°C. [87·8–89·6°F.].

The only natural enemy observed was *Pyemotes* (*Pediculoides*) *ventricosus* (Newp.), which attacked the eggs and pupae of both species. In experiments on control, good results were given against both Bruchids by fumigating the seeds immediately after harvest with about 13–19 lb. carbon bisulphide or

1·5–2 lb. hydrogen cyanide per 1,000 cu. ft. for 24–48 hours at temperatures above 13°C. [55·4°F.]. For control of the adults in the field, dusting with 12 per cent. BHC or 5 per cent. DDT, beginning when the pods ripen, gave excellent results. Laboratory tests with ten dust materials are described, some being preparations of unspecified composition. The best results were given by BHC and methyl-parathion (Wofatox). Several materials gave good results when applied to infested seeds, including DDT, BHC and methyl-parathion. All insects were killed by cold when infested seeds were kept in the open during the winter. Exposure of seeds in a thin layer to 52–55°C. [125·6–131°F.] for 30 minutes also gave complete mortality.

Popov (P. A.). **Untersuchungen über die Gattung *Melolontha* in Bulgarien.** [Investigations on the genus *Melolontha* in Bulgaria.]—*Z. PflKrankh.* **67** pt. 7 pp. 399–407, 6 figs. Stuttgart, 1960. (With a summary in English.)

Observations carried out over six years in Bulgaria showed that the species of *Melolontha* present were *M. melolontha* (L.), which was represented by several varieties or forms, *M. pectoralis* Germ. and *M. farinosa* Kraatz; *M. hippocastani* F., which has been recorded from Bulgaria, was not found. The distribution of the three species observed is shown on a map. *M. melolontha* was by far the commonest and injured numerous plants in its larval or adult stages; lists of these are included. Details of its life-cycle, which lasted three years, are given, and of tests on its control by means of dusts of BHC, parathion or DDT applied against the adults and by various soil insecticides against the larvae.

Orlob (G.) & Bradley (R. H. E.). **Drei weitere Blattlausarten, die das Y-Virus der Kartoffel mit den Stechborstenspitzen übertragen.** [Three further species of aphids that transmit potato virus Y with the stylet tips.]—*Z. PflKrankh.* **67** pt. 7 pp. 407–409, 4 refs. Stuttgart, 1960. (With a summary in English.)

The following is virtually the authors' summary. When *Myzus certus* (Wlk.), *Macrosiphum euphorbiae* (Thos.) and *Aphis nasturtii* Kalt. acquired potato virus Y during brief probes into tobacco, they did not transmit it after they were irradiated with ultraviolet light, with the tips of their stylets exposed to the radiation. Although this alone is not conclusive evidence, it seems that these species also carry virus Y at the stylet tips, as has previously been shown for *Myzus persicae* (Sulz.) [*cf. R.A.E.*, A **45** 367].

Stančić (J.). **Gundelj na području Vlasenice i Srebrnice (Bosna).** [The cockchafer in the district of Vlasenica and Srebrnica (Bosnia).]—*Plant Prot.* no. 44 pp. 3–25, 2 maps, 2 graphs, 19 refs. Belgrade [1958]. (With a summary in English.)

Melolontha melolontha (L.) is widespread in Yugoslavia and is sometimes injurious, particularly in mountain regions. Observations are recorded on a newly discovered focus of the insect in eastern Bosnia. The life-cycle usually lasted three years, but four were required in individual cases. The larvae caused much damage in meadows and pastures, and some to cereals and vegetable crops. It was observed that the pupal stage, which usually lasted 1·5–2 months, was sometimes prolonged to 10 months or more, as a result of

anomalous conditions. It is suggested that the insect overwinters as a pupa when the larva pupates late in the autumn. The adults emerged from the end of April to the end of May, and sprays of 0·2–0·25 per cent. lindane [almost pure γ BHC] applied at the time of emergence to shrubs on which they congregated usually gave satisfactory control, but had sometimes to be supplemented by aerosol treatment.

Bjegović (P.). **Ražena mušica-štetočina raži u planinskim predelima Besne Kobile i Kukavice.** [*Contarinia tritici*—a rye pest in the mountainous regions of Besna Kobila and Kukavica.]—*Plant Prot.* no. 44 pp. 35–49, 2 graphs, 30 refs. Belgrade [1958]. (With a summary in English.)

Contarinia tritici (Kby.) causes extensive damage to rye sown on shady slopes in certain mountain regions of Serbia and is much more injurious than it is in the plains, where it mainly infests wheat. In 1954, it caused 81·4 per cent. loss of seed yield. Observations showed that the adults emerged in the second half of June, and that the larvae became full-fed in three weeks and entered the soil to a depth of 2–3 in. For pupation, they ascended to the surface layer. Some of the larvae pupated and gave rise to adults in the same autumn, but most did so in the following spring, while a few remained in diapause over two or even three winters. The larvae were very resistant to low temperature and humidity. Good control of the adults was given by DDT aerosols and a BHC spray, though the effectiveness of the latter was short-lived. Two applications a week apart when the grain is entering the ear stage are recommended.

Bebić (N.). **Avio-zamagljivanje gusenica gubara u Kosovu 1956 godine.** [Aero-misting against larvae of *Lymantria dispar* in Kosovo in 1956.]—*Plant Prot.* no. 44 pp. 51–62, 3 refs. Belgrade [1958]. (With a summary in English.)

Details are given of experiments in which DDT aerosols applied by aeroplane gave good control of the larvae of *Lymantria dispar* (L.) [*cf. R.A.E.*, A **46** 289] in forests in the Kosovo district of Yugoslavia in May–June 1956. It was observed that adults from larvae that survived the treatment were sterile.

Sidor (C.) & Jovanović (M.). *Otiorrhynchus lavandus* **Germ. štetočina Fruškogorskih vinograda.** [*O. lavandus*, a pest of vineyards in Fruška Gora.]—*Plant Prot.* no. 44 pp. 73–82, 9 pls., 5 refs. Belgrade [1958]. (With a summary in English.)

Otiorhynchus lavandus Germ., the egg, larva and adults of both sexes of which are described, was observed in Vojvodina in 1956 and the spring of 1957 causing great injury to vines [*cf. R.A.E.*, A **17** 578]. Most of the damage was done in March and April, when the adults, which overwinter at depths of 3·2–4 in. in the soil resumed activity and fed on the fruit buds and young leaves, but it continued throughout the season. Numerous other plants, including wild plants and fruit trees, were also attacked. Feeding occurred at night, and the insects hid in the soil by day. The eggs are laid in the soil, and, in the laboratory, oviposition began only after 42 days of feeding. The eggs hatched in 9 days at 26°C. [78·8°F.], 49·2 per cent. doing so at 70 per cent. relative humidity and all at 100 per cent. In tests of control by means of insecticide treatment of the soil round the vines on

30th March, complete mortality was given by γ BHC (lindane) and by malathion at a sufficient rate of application, but parathion had no effect. In later tests, excellent results were given by DDT sprays or γ BHC dusts applied to the soil round the vines and by spraying the leaves and fruit buds with lead arsenate.

Tešić (T.). **Suzbijanje graškovog žiška u polju.** [Field control of *Bruchus pisorum*.]—*Plant Prot.* no. 44 pp. 89–98, 10 refs. Belgrade [1958]. (With a summary in English.)

Bruchus pisorum (L.) was very abundant and caused up to 60 per cent. loss of peas in several districts in Serbia in 1956. In tests of proprietary contact insecticides, dusts containing 0·7 per cent. lindane [almost pure γ BHC], 5 per cent. BHC, 2 per cent. parathion, 4 per cent. malathion, an unspecified amount of toxaphene or a mixture of 4·65 per cent. DDT and 0·75 per cent. γ BHC were applied at 18–22·5 lb. per acre. The best results were given by two applications, the first at the beginning of oviposition, which occurred just before flowering, and the second a few days later. The two dusts containing BHC alone reduced the percentage of seeds infested to 3·9–5·2, toxaphene and the mixture were almost as effective as γ BHC and the others permitted over 9 per cent. infestation.

Pavlov (I. F.). **The survival of the larvae and the number of generations of the Hessian fly.** [*In Russian.*]—*Zool. Zh.* **37** pt. 12 pp. 1831–1841, 15 refs. Moscow, 1958. (With a summary in English.)

The weather in the central black-soil zone of the Soviet Union is sometimes warm enough in autumn for late-sown winter wheat to be infested by *Mayetiola destructor* (Say). Examination of records for 1925–52 kept at a meteorological station in the Kamennaya steppe showed that only in six years was September cold enough to prevent oviposition and only in ten was October cold enough to prevent the larvae from reaching the pupal stage. The young larvae are susceptible to cold, but the older ones sometimes survive the winter and do not form puparia until the spring, and the number that survived in this way in 1953–54 was considerable, although conditions were unfavourable. It has been considered that the Cecidomyiid has only two generations a year in the region and that infestation of winter wheat can be forecast as early as June [*R.A.E.*, A **48** 243–244]. Observations are recorded, however, from which it is concluded that there are three generations of *M. destructor* a year, though fewer may develop and their size will vary in a particular year or place because of the occurrence of diapause when the weather is hot and dry. Forecasting is thus not so easy.

Naumov (R. V.). **On the causes of the cessation of mass outbreaks of *Euproctis chrysorrhoea*.** [*In Russian.*]—*Zool. Zh.* **38** pt. 1 pp. 133–134, 5 refs. Moscow, 1959. (With a summary in English.)

Outbreaks of *Euproctis chrysorrhoea* (L.), on fruit and forest trees in the European part of the Soviet Union are sometimes terminated by insectivorous birds or diseases, but one that occurred in oak forests in one district in 1949–55 was apparently eliminated by a food factor. The larvae normally feed on mature oak leaves in autumn before hibernation, and the secondary growth that develops after the trees have been defoliated is less suitable, being rich

in water and proteins but deficient in cellulose and sugars. As a result, the larvae grow rapidly, but are poorly adapted for hibernation, and mortality is high when cold weather sets in. Observations supporting this view are recorded. The simultaneous decrease in population in orchards not subject to defoliation is attributed to the cessation of migration to them from the forests, which allows the normal winter control measures to remain effective.

Shapovalov (A. A.). *Laspeyresia woeberiana* **Schiff.—a pest of cherry in the Kamennaya steppe.** [*In Russian.*]—*Zool. Zh.* **38** pt. 2 pp. 284–285, 3 refs. Moscow, 1959. (With a summary in English.)

Enarmonia (*Laspeyresia*) *woeberiana* (Schiff.) causes serious damage to cherry and other stone fruit trees in the central black-soil zone of the Soviet Union by boring beneath the bark of the lower trunk. Its habits are described [*cf. R.A.E.*, A **45** 329]. Dusting the bark with DDT during the flight period or painting it with lime or a clay mixture to which DDT or BHC has been added is recommended.

Gerasimov (B. A.) & Osnitskaya (E. A.). **Pests and diseases of vegetable crops.**—[4+] 97 pp., 46 figs. Jerusalem, Israel Progr. sci. Transl., 1960. (Translated from Russian original published in 1957.)

This booklet contains general information on the pests and diseases of vegetables in the Soviet Union and their control, followed by special sections on those affecting particular crops. For insect pests, the matter includes notes on bionomics, distribution and the damage caused. The diseases include those caused by viruses, and mention is made of insect vectors where appropriate.

Tanskiĭ (V. I.). **Comparative infestation of varieties of spring wheat by the wheat thrips,** *Haplothrips tritici* **Kurd. and its injuriousness in northern Kazakhstan.** [*In Russian.*]—*Trud. vsesoyuz. Inst. Zashch. Rast.* **11** pp. 7–25, 4 figs., 14 refs. Leningrad, 1958.

Observations on *Haplothrips tritici* Kurd., a serious pest of wheat in northern Kazakhstan [*cf. R.A.E.*, A **49** 195], showed that autumn-sown crops are little attacked. The mass flight of the adults coincides with the earing stage of spring-sown wheat, and this is the most severely infested crop. When ear formation is slow, infestation is heavy. The number of nymphs per ear is greatest during the milky stage of ripeness, and yield losses amounted to 5·5–7·5 per cent., with little difference between varieties.

Sinitsyna (L. P.). **Biological peculiarities of** *Chlorops pumilionis* **and conditions restricting its reproduction in different parts of its range.** [*In Russian.*]—*Trud. vsesoyuz. Inst. Zashch. Rast.* **11** pp. 26–51, 10 figs., 29 refs. Leningrad, 1958.

The following is based largely on the author's summary. *Chlorops pumilionis* (Bjerk.), a serious pest of wheat and barley, is widespread in the European part of the Soviet Union. Observations under laboratory conditions showed that its development was possible between 9–10°C. [48·2–50°F.] and a relative humidity of 60 per cent. and 32–33°C. [89·6–91·4°F.] and a

humidity of 100 per cent. The optimum temperature was 16–25°C. [60·8–77°F.] and 75–100 per cent. relative humidity, but was somewhat higher for the second generation than the first. When the temperature during the larval and especially the pupal stage exceeded 25–26°C. [77–78·8°F.], the adults entered diapause, and this was terminated only by exposure to low temperatures (15–16°C. [59–60·8°F.]) for at least 10–15 days. The insect is the most susceptible to unfavourable conditions in spring, in the egg stage and before the newly hatched larvae have entered the stalks. The distribution of *C. pumilionis* in the Soviet Union is discussed in relation to these results.

Panshina (E. I.). **An attempt to estimate the beneficial activity of some insectivorous birds during the nesting period in pine plantations in the forest-steppe.** [*In Russian.*]—*Trud. vsesoyuz. Inst. Zashch. Rast.* **11** pp. 52–73, 3 graphs, 28 refs. Leningrad, 1958.

Details are given of observations in pine forests in the Voronezh region of the Soviet Union in 1954–56, showing that the great tit (*Parus major*) is of more value than certain other insectivorous birds in feeding on the various stages of forest insects, particularly adults of *Bupalus piniarius* (L.) and larvae of *Dendrolimus pini* (L.).

Petrova (I. A.). **On the formation and distribution of the foci of** *Saperda carcharias* **L. in the Savala forest.** [*In Russian.*]—*Trud. vsesoyuz. Inst. Zashch. Rast.* **11** pp. 74–84, 4 figs., 23 refs. Leningrad, 1958.

Observations in 1955–56 in two localities in the steppe zone of the Soviet Union showed that up to 10 per cent. of poplars growing in plantations on low ground in a river valley were infested by *Saperda carcharias* (L.), as compared with 60–100 per cent. of those growing in higher, drier situations. The Lamiid preferred unmixed plantations growing in unfavourable conditions, and these were therefore more susceptible to infestation.

Churaev (I. A.). **On the problem of the injuriousness and food specialisation of the American white butterfly (*Hyphantria cunea* Drury).** [*In Russian.*]—*Trud. vsesoyuz. Inst. Zashch. Rast.* **11** pp. 85–101, 5 figs., 23 refs. Leningrad, 1958.

Hyphantria cunea (Dru.) spread to the Transcarpathian region of the Soviet Union in 1951–52 [*cf. R.A.E.*, A **45** 330] and has since caused great damage to deciduous trees and other plants; a list of 48 found infested is given. Those most injured are mulberry, *Acer negundo* and fruit trees; on the latter, defoliation was sometimes accompanied by superficial damage to the fruits. Observations in 1953–56 showed that one larva can eat 10–12 medium-sized apple or mulberry leaves. There are two generations a year, and the larvae of the second proved far more numerous and injurious than those of the first. Mulberry was preferred for oviposition, and the larval stage was shortest and mortality least on it. No eggs were laid on oak or horse chestnut [*Aesculus hippocastanum*], and larval development was the most protracted on the former and not completed on the latter. DDT sprays are recommended for control. They should be applied against larvae of the first generation, so as to prevent the occurrence of a large second generation, and remain effective for 30–50 days, depending on concentration.

Poznanin (L. P.). **Ways and means of using birds in combating noxious insects.**—[5 +] 138 pp., illus., refs. Jerusalem, Israel Progr. sci. Transl., 1960. (Translated from Russian original published in 1956.)

This is a collection of 28 papers read at conferences held in the Soviet Union in 1953 and 1954. In addition to information on the feeding and nesting habits of insectivorous birds, they include accounts of investigations on methods of attracting such birds to forest stands for the control of insects.

Fedotov (D. M.). Ed. **The noxious Pentatomid** *Eurygaster integriceps* **Put. Collection of works of the Laboratory of Invertebrate Morphology. Vol. 4.** [*In Russian.*]—239 pp., 49 figs., many refs. Moscow, Akad. Nauk SSSR, 1960. Price 14 *rub.*

This further volume of reports of research on *Eurygaster integriceps* Put. and its natural enemies in the Soviet Union [*cf. R.A.E.*, A **40** 307; **46** 8] contains accounts of further investigations in the Krasnodar region in 1954–57. It consists of an introductory review by the editor (pp. 3–5), including a summary of the annual fluctuations in the infestation of cereals by the bug in this region, and nine papers by other authors, of which abstracts appear below.

Bocharova-Messner (O. M.). **The digestive apparatus of the noxious Pentatomid (*Eurygaster integriceps* Put.) and the functional specificity of its sections** (pp. 6–32, 11 figs., 62 refs.). The following is based on the author's summary. The gut of *E. integriceps* serves not only for purposes of digestion, but also as a water-regulating organ, permitting replenishment of water deficit and elimination of water surplus from the organism, as a food-storing organ, since reserve substances such as fat and glycogen are stored in the epithelium, as an excretory organ, since uric acid is also stored in it, and as the locus of symbiotic bacteria, which participate not only in digestion but also in general metabolic processes. These various supplementary functions and their localisation in the gut are discussed in some detail.

Sazonova (G. V.). **Biological peculiarities of the noxious Pentatomid (*Eurygaster integriceps* Put.) in the conditions of the Lower Volga** (pp. 33–57, 3 figs., 77 refs.). The following is based on the author's summary. The most suitable period for the control of *E. integriceps* in grain fields in the Lower Volga district is the early spring, when the bugs fly to them from their winter quarters and may completely destroy spring-sown crops. Injuriousness at this time varies with the weather, however, and is reduced if this is rainy and cool. The males of *E. integriceps* are the first to appear, together with *E. austriaca* (Schr.), since they are physiologically more active and have smaller food reserves than the females. They constitute the majority of the bugs killed by early-spring treatment with DDT. For the first 30–35 days after the appearance of *E. integriceps*, the temperature fluctuates considerably, especially in fields of spring-sown cereals, since the young plants provide little cover. During this period (May), the bugs readily congregate under shelters, and use can be made of this habit for control by means of bait-shelters [*cf.* **49** 216]. During the oviposition period, which lasts 30–40 days, warmer conditions are established. In the earlier part of it, the females lay most of their eggs on the lower leaves or under shelters, and it is these eggs that determine the beginning of the hatching period. Later, the eggs are mostly laid on the middle or upper leaves of the partly grown plants, and it is these that determine the date of mass hatching. In a cold, late spring, there may be a considerable interval between the beginning of

hatching and its peak, and control measures should be timed in accordance with the latter, and not the appearance of the first nymphs.

Water in the shape of drops is essential for the development of the first-instar nymphs. This is normally available in the form of dew, and absence of dew may cause the nymphs to suck the stalks and leaves of the wheat. The second-instar nymphs are able to feed on the vegetative parts of the plants without undue mortality, but their development is protracted by such unfavourable food; however, this enables them to survive if plant development is delayed.

The stage of plant growth reached by the time the adults emerge is of importance, since it determines the period for which the bugs can feed before the grain is harvested and hence their ability to overwinter. Emergence usually coincides with the stage of waxy or complete ripeness of spring wheat in the Lower Volga district, and the technique of divided harvesting [*cf.* **48** 241] therefore deserves consideration.

The bugs hibernate in woods, lowlands or gullies, mountain oak forests and shelter belts, chiefly in the first three. In gullies, they are easily controlled by biological [*cf.* **48** 348] or chemical means [*cf.* **48** 347]. Mortality is high if overwintering conditions are damp, with frequent frosts and no snow cover in the early part of the winter, since this leads to freezing, and it can be increased by disturbance of the ground litter.

Bel'kevich (V. I.). **The physiology of the noxious Pentatomid (*Eurygaster integriceps* Put.) during the period of preparation for diapause** (pp. 58–97, 13 graphs, 103 refs.). The following is based on the author's summary. Weather conditions greatly influence the rapidity of development of *E. integriceps* and the accumulation of reserves of food and fat in the mid-gut of the young adults, which depend on these for winter survival. Extra-intestinal preparation of the food [*cf.* **48** 345] facilitates rapid feeding and assimilation. Seven periods of metabolism are distinguished in the life of the bug. The first comprises the first nymphal instar, in which oxygen absorption is the most intense, fats are used as the energy substrate, and resistance to unfavourable factors, including toxicants, is least. In the second, the remainder of the nymphal stage, feeding is intense, carbohydrate-proteins serve as the energy substrate, and fats are synthesised, especially in the last two instars, in which they gradually replace the carbohydrates as the substrate. In this stage, resistance to unfavourable conditions increases, but the bugs remain susceptible to DDT. The third period is that of the development of the young adults and their preparation for hibernation. Fat reserves are laid down and then food reserves [*cf.* **47** 355], respiration increases and then decreases towards the onset of the diapause, together with the activity of the digestive enzymes, and resistance to DDT increases. The fourth period, that of hibernation [*cf.* **46** 9], consists of a period of diapause during which metabolism slows down with the fall in temperature, followed by a period during which development can be resumed as soon as the temperature permits. The fifth period is that of the general resumption of activity and the beginning of oviposition, when the insect is very resistant to DDT. The sixth is that of mass oviposition, when feeding and expenditure of fat-body are intense and resistance to DDT decreases rapidly [*cf.* **49** 83]. The seventh is the period of senescence and death, during which all activities gradually cease.

The diapause may be considered to begin as soon as feeding by the young bugs ceases, and the physiological phenomena associated with its onset are described. They all lead to a reduction in metabolism and hence to an increase in resistance to toxicants.

Viktorov (G. A.). **Individual development and ecology of the golden Phasia, *Clytiomyia helluo* F. (Diptera, Larvaevoridae)** (pp. 98–119, 7 figs.,

23 refs.). The following is based on the author's summary. *Clytiomyia helluo* (F.), an important parasite of the adults of *E. integriceps*, produces two generations a year in this host in the Krasnodar region. Parasitism leads to abnormality of the reproductive system, but not to other noticeable changes, so that the bugs often survive for long periods after the larvae of the Tachinid have left them. Parasitism before the bugs fly to their hibernation sites leads to degeneration of the sexual system of the males and prevents that of the females from developing. Parasitism after overwintering has little effect on the males, but causes degeneration of the developing oocytes in the females. The population of the parasite varies widely in different years, largely as a result of variations in the period available for summer oviposition, which depends on the dates of adult emergence and harvest.

Viktorov (G. A.). **The method of calculating the effectiveness of egg-parasites of the noxious Pentatomid** (*Eurygaster integriceps* **Put.**) (pp. 120–124, 8 refs.). Calculation of the percentage parasitism afforded by egg-parasites is simple in the case of a species producing only one generation in the eggs of a host that oviposits over a short period, but is more difficult in that of species producing several generations in those of a host with a prolonged oviposition period, especially if the development of the parasite takes longer than the duration of the egg stage of the host. Such a case is that of the Scelionids, notably *Telenomus sokolowi* Mayr and *Microphanurus semistriatus* (Nees), that parasitise the eggs of *E. integriceps*. Published data on the effectiveness of these are reviewed, and it is shown that the best results can be obtained by counts including not only developing eggs but also those from which *E. integriceps* or the parasites have already emerged, and these should be treated as cumulative totals. The result will still be subject to error, since eggs from which insects have emerged do not always persist until the end of the oviposition period, owing to the effects of rain and wind.

Strogaya (G. M.). **The physiological condition of the noxious Pentatomid** (*Eurygaster integriceps* **Put.**) **in different hibernation sites in the Krasnodar region** (pp. 125–141, 32 refs.). The following is based on the author's summary. Observations in the Krasnodar region supported the view that the vertical distribution of *E. integriceps* in its hibernation sites depends on the degree of repletion of the bugs [*cf.* **47** 143], so that much can be learned from it as to the probable future course of numbers. Some of the bugs hibernate in the plains, and these comprised not only individuals that had not completed their feeding, but also some showing a higher degree of nutrition than those hibernating in the mountains. Evidently, some local populations are adapted to overwintering in forests close to the fields in which they develop [*cf.* **46** 10]. Investigations on the expenditure of reserve substances in the main body of bugs hibernating in the mountains showed that the most favourable overwintering conditions occurred on damp well-shaded northern slopes. Conditions were less favourable on the tops of hills, where there was more warmth and less permanent moisture, and least so on tree-less summits and southern slopes exposed to the sun and wind, where expenditure of reserve materials was sometimes so high as to lead to exhaustion and death. If the weather is unusually warm and dry, sites that are normally unfavourable because of excessive humidity become the most favourable. The higher overwintering sites, which are sought by the best-fed and physiologically strongest bugs, do not always provide the best conditions. If they are exposed to sun and wind, the condition of the bugs soon declines to that of bugs hibernating at lower elevations. The greatest expenditure of fat occurs immediately after the flight to the winter quarters, while the bugs are still fairly active, and it is at that time about the same in males and females. Later, with the cessation of sexual development in the females, fat consumption decreases in them, but it is maintained at its original level in males.

Biryukova (A. G.). **Variation of the morphofunctional state of the noxious Pentatomid (*Eurygaster integriceps* Put.) in 1954–57 in the Krasnodar region** (pp. 142–156, 7 figs., 19 refs.). The following is based on the author's summary. *E. integriceps* was not particularly numerous in the Krasnodar region in 1954, but the weather was favourable and the young adults migrated to their winter quarters in a good physiological state. Winter conditions were also favourable, and the abundance of the bugs in 1955 accordingly increased and their physiological state was improved. Weather conditions were good, and fecundity increased to a level of 20–30 or more young bugs per overwintered female. Crop damage also increased. The bugs migrated to their winter quarters in good condition and were more numerous there than in the preceding year. The winter was passed successfully. Conditions were unfavourable in 1956, and constant rain delayed oviposition. Adult emergence and the flight to winter quarters were hindered by changeable weather, and the bugs entered hibernation in a worse state than in 1955. Their abundance in the principal sites was reduced. The overwintered population was low in 1957 and in an inferior physiological state, but their condition had improved by the time of mass oviposition. The weather favoured normal development, but the increase in numbers was low and the overwintering population was reduced. The state of the overwintering bugs was fairly good, but mass mortality of males occurred in the principal hibernation sites.

Polivanova (E. N.). **Eco-morphological peculiarities of bugs of the superfamily Pentatomoidae in the southern grain regions of the European part of the USSR** (pp. 157–221, 8 figs., 165 refs.). The author describes anatomical features of *E. integriceps*, especially those of the reproductive and digestive systems, and shows how they differ from those of other Pentatomids. It also differs from others that infest cereal crops in having a short period of development in the field and being entirely dependent on cereals for its food. This leads to much greater variations in population than is the case with species that have more than one generation a year and less specialised feeding habits [*cf.* **46** 286].

Viktorov (G. A.). **Factors in the dynamics of numbers of the noxious Pentatomid (*Eurygaster integriceps* Put.) in the Kuban in 1956–58** (pp. 222–236, 16 refs.). The author describes the weather conditions in the Kuban district in 1956–58 and records the results of investigations on the changes in population of *E. integriceps* in grain fields and hibernation sites, in the morphofunctional state of the bugs and in parasitism of the eggs by Scelionids and of the adults by Phasiine Tachinids during the period. The results showed a lack of correlation between morphofunctional state or weather conditions and change in population density [*cf.* **46** 8], but a close connection with the activity of the parasites, particularly the Scelionids. The application of DDT dusts against *E. integriceps* had an unfavourable effect on the parasites, and especially on the Tachinid, *Clytiomyia helluo* (F.), which develops solely in adults of *E. integriceps* [*cf.* **49** 292]. It is emphasised that these results apply to one district only, and that conditions may differ elsewhere.

Yoshida (M.) & Suzuki (Y.). **Testing laboratory methods of agricultural chemicals against injurious insects in soil.**—*Botyu-Kagaku* **23** pt. 3 pp. 107–111, 1 graph, 6 refs. Kyoto, 1958. (With a summary in Japanese.)

Laboratory tests of insecticides against wireworms in Japan have been hampered by lack of a technique for maintaining the humidity of the soil

without affecting its other properties. A method is described by which larvae of *Melanotus caudex* Lewis were maintained in moist, sterilised sawdust, and the results of tests of insecticides against them are recorded.

Ogita (Z.). **The genetical relation between resistance to insecticides in general and that to phenylthiourea (PTU) and phenylurea (PU) in** *Drosophila melanogaster*.—*Botyu-Kagaku* **23** pt. 4 pp. 188–205, 15 refs. Kyoto, 1958. (With a summary in Japanese.)

The following is based on the author's summary and discussion. The levels of resistance to phenylthiourea (PTU) and phenylurea (PU) were determined for strains of *Drosophila melanogaster* Mg., of which some were resistant and others susceptible to DDT, BHC and parathion. Strains resistant (or susceptible) to PU were also resistant (or susceptible) to DDT. All the strains that were resistant to PTU were susceptible to DDT, but those susceptible to PTU were of two types, one DDT-resistant and the other DDT-susceptible. Genetical analysis indicated that a dominant gene that confers resistance to DDT, BHC and parathion also confers resistance to PU and abnormal susceptibility to PTU, and a logical outcome of this is to consider that PTU pressure could restore DDT-susceptibility to a strain that has become resistant. It is suggested that a mixture of DDT, BHC or parathion with a substance correlated negatively with them, such as PTU, might prove to be an effective insecticide that would not produce strains resistant to it even after continuous use.

Evans (W. G.) & Gyrisco (G. G.). **The influence of light intensity on the nocturnal emergence of the European chafer.**—*Ecology* **39** no. 4 pp. 761–763, 5 refs. Brooklyn, N.Y., 1958.

The following is virtually the authors' summary of this account of investigations in New York State. By measuring the light intensity at the time of emergence of the European chafer (*Amphimallon majalis* (Razoum.)) during the evening and by conducting experiments with this beetle in a cage in which the light intensity could be altered, it was found that emergence, though not necessarily flight, took place at light intensities of less than 32 foot-candles. Some unknown factor or set of factors is involved in the migration of the adults to the surface of the soil and in causing the chafer to fly, since lowered light intensities can bring about emergence, but not flight, during the day. Light intensity therefore acts as a triggering mechanism for maintaining the periodical activity of *A. majalis*.

Curry (S. J.) & Griffiths (J. F.). **Temperature changes within cypress logs in the Kenya Highlands.**—*Ecology* **40** no. 3 pp. 490–491, 3 graphs. Brooklyn, N.Y., 1959.

The following is virtually the authors' summary. Temperature measurements were taken within seasoned and freshly felled logs of cypress (*Cupressus lusitanica*) under various conditions in the Kenya Highlands. These showed that seasoned timber reached much higher temperatures than green wood, values of well over 130°F. being recorded. The thermal gradient

within the logs was very steep. Exposure of larvae of *Oemida gahani* (Dist.) [*cf. R.A.E.*, A **45** 373], boring near the centre of similar logs, to comparable temperatures in an electric oven showed that they could survive at higher temperatures, sustained for longer periods, than those measured in field conditions. As the highest temperatures measured in the field occurred only near the surface of the seasoned log, it is considered unlikely that *Oemida* larvae, boring in the heartwood of both fresh and seasoned cypress logs, could be killed by the increase in the temperature of the timber resulting from its exposure to the sun in plantations.

Morris (R. F.). **Single-factor analysis in population dynamics.**—*Ecology* **40** no. 4 pp. 580–588, 3 graphs, 4 refs. Brooklyn, N.Y., 1959.

The following is virtually the author's summary. Examples of single-factor analysis are presented for natural populations of two defoliating insects that are common in the coniferous forests of New Brunswick. One is the native *Acleris variana* (Fern.), which attacks fir [*Abies*] and spruce, and the other the introduced *Gilpinia* (*Diprion*) *hercyniae* (Htg.), which infests spruce. Population density was measured at one point in the larval stage in each generation, and the analysis is concerned only with population changes from generation to generation. The larvae collected during population sampling were dissected or reared to determine the percentage parasitism, and the object of the analysis was to learn whether parasitism, as a suspected 'key factor', could be used effectively to predict population density in the next generation. Parasitism was found to have high predictive value for *A. variana* but a lower predictive value for *G. hercyniae*. Prediction was improved, however, when adjustments were made to make allowance for the effects of associated mortality factors and for the interference between these factors and parasitism. In the case of *G. hercyniae*, at least, there is reason to believe that parasitism derives part of its predictive value from the fact that it indicates the mode of action of associated factors having a similar type of response to changes in population density. It is concluded that parasitism is a key factor in the two populations, in the sense that it has useful predictive value, and that single-factor analysis can provide valuable leads to more intensive and conclusive multi-factor investigations.

Shepherd (R. F.). **Phytosociological and environmental characteristics of outbreak and non-outbreak areas of the two-year cycle spruce budworm, *Choristoneura fumiferana*.—*Ecology* 40** no. 4 pp. 608–620, 11 figs., 23 refs. Brooklyn, N.Y., 1959.

The following is virtually the author's summary. In the Canadian Rocky Mountains, *Choristoneura fumiferana* (Clem.) maintains a two-year life-cycle on Engelmann spruce (*Picea engelmanni*) and alpine fir (*Abies lasiocarpa*), overwintering in the second and fourth instars. The life-cycles are largely co-ordinated into one brood, so that most adults are found during even-numbered years. While the budworm can usually be found in most of the stands, populations in certain restricted stands are consistently higher. The latter are called outbreak areas and can be recognised easily by marked defoliation and conspicuous red tops. In the non-outbreak areas, the budworm may be quite common and many new shoots may sometimes be defoliated, but extensive defoliation does not occur.

Snapp (O. I.). **Plum curculio control experiments in 1955–58.**—*J. econ. Ent.* **53** no. 3 pp. 335–337, 2 refs. Menasha, Wis., 1960.

The following is based on the author's abstract of this account of investigations on the control of *Conotrachelus nenuphar* (Hbst.) on peach in Georgia in 1955–58. Azinphos-methyl (Guthion) and Sevin gave good residual control and Trithion good immediate control, with little residual effect, in cage tests with sprays. In field tests, the recommended regular schedule of five applications of 2 lb. 15 per cent. wettable parathion per 100 U.S. gal. controlled light to moderate infestations, but a split schedule of three applications of 1 lb. 50 per cent. wettable dieldrin, followed by two of 2 lb. 15 per cent. wettable parathion per 100 U.S. gal., was more effective. Azinphos-methyl was about as effective as parathion, and Sevin and ethyl-DDD (Perthane) were promising. Malathion, diazinon and heptachlor were less effective than parathion, and trichlorphon (Dipterex), Chlorthion, aldrin and Strobane had little value. Dieldrin was less effective at 0·25 than at 1 lb. per 100 U.S. gal., but should not be used later than two weeks after the shuck-off stage at either strength. Residues of azinphos-methyl and Sevin at harvest were well below the approved tolerance of 0·1 part per million on peaches, and those of ethyl-DDD were 1·3–2·1 p.p.m. Lime did not interfere with the effectiveness of parathion or malathion. An application at petal-fall was found to be of value.

Mason (H. C.), Henneberry (T. J.) & Lehr (R.). **Reaction of *Drosophila* to different varieties of tomatoes.**—*J. econ. Ent.* **53** no. 3 pp. 337–339, 1 fig., 2 refs. Menasha, Wis., 1960.

Investigations in Maryland in 1954–56 to find whether tomatos of different varieties differ in attractiveness to adults of *Drosophila melanogaster* Mg. [*cf. R.A.E.*, A **45** 278] are described. Counts of adults trapped in jars or of eggs laid in slit ripe tomatos showed that two varieties were rather less attractive than 13 others, which differed considerably among themselves.

Strong (R. G.) & Sbur (D. E.). **Influence of grain moisture and storage temperature on the effectiveness of malathion as a grain protectant.**—*J. econ. Ent.* **53** no. 3 pp. 341–349, 4 figs., 11 refs. Menasha, Wis., 1960.

The following is based on the authors' abstract of this account of investigations in California on the effect of moisture content, storage temperature and the interrelation of moisture, temperature and dosage on the effectiveness of malathion in protecting stored wheat against *Sitophilus granarius* (L.), *S. oryzae* (L.) and *Tribolium confusum* Duv. When malathion was applied at 10 parts per million to wheat with moisture contents in the range of 10–20 per cent. that was stored at 60°F., the mortality of the insects decreased as the moisture content was increased; 12 per cent. moisture seemed to be about the maximum safe level, and 14 per cent. the critical level for the persistence of effective malathion residues. The effectiveness of malathion applied at 10 p.p.m. to wheat containing 10 per cent. moisture and stored in temperature-controlled cabinets in a graded range of 60–120°F. decreased with rise in temperature, but maximum safe temperature ranges for the persistence of effective levels of malathion on grain in storage were not clearly defined. Tests on the interrelation of dosage with these factors showed that 10 p.p.m. malathion

would remain effective against the insects for at least 12 months when storage temperature did not exceed 60°F. or the moisture content 14 per cent., but that increase of dosage would be desirable to compensate for adverse effects of moisture and temperature that might be found in practice.

Butcher (J. W.) & Haynes (D. L.). **Influence of timing and insect biology on the effectiveness of insecticides applied for control of European pine shoot moth,** *Rhyacionia buoliana*.—*J. econ. Ent.* **53** no. 3 pp. 349–354, 1 graph, 10 refs. Menasha, Wis., 1960.

Pinus sylvestris (Scots pine), *P. resinosa* (red pine) and other species of *Pinus*, grown for the Christmas-tree market in Michigan, are attacked by *Rhyacionia buoliana* (Schiff.), and the proper timing of sprays against this Tortricid [*cf. R.A.E.*, A **45** 154; **47** 94, etc.] was investigated in 1959. There was evidence that the formation of new pitch masses by larvae resuming feeding after the winter, or by migrating larvae, might extend over long periods in some years, and experimental results suggested that the spring application should be delayed until they are seen. Applications of 1 lb. dimethoate or mevinphos (Phosdrin) or 2 lb. DDT per 100 U.S. gal. emulsion spray at this time gave very good control [*cf.* **47** 94], and 1 lb. azinphos-methyl (Guthion) in emulsion and 2 lb. methoxy-DDT (methoxychlor) or Bayer 22408 (O,O-diethyl O-naphthalimido phosphorothioate) in wettable-powder sprays were promising.

The results of applications on seven dates between the times of 60 per cent. adult emergence and 90 per cent. egg hatch showed that summer treatments should be delayed until at least half the eggs have hatched. Evidence that the newly hatched larvae always move first to the needles and then to the buds to feed shows the desirability of having a maximum amount of insecticide on the trees at this time [*cf.* **49** 231]. Sprays containing 1 lb. DDT or 2 lb. dimethoate in emulsion concentrate or 2 lb. Sevin per 100 U.S. gal. were the most effective.

Madsen (H. F.) & McNelly (L. B.). **Control of the grape mealybug on apricots.**—*J. econ. Ent.* **53** no. 3 pp. 354–357, 2 figs., 6 refs. Menasha, Wis., 1960.

Damage to apricots observed at harvest in 1956 in California was found to be caused by *Pseudococcus maritimus* (Ehrh.), which had not previously been known to infect this crop. The crawlers of the summer generation collected at the stem end of the fruits and produced honeydew that caused discoloration and was difficult to remove. Observations in 1957–59 showed that the adults emerged in August, after harvest, and deposited eggs in protected places on the bark. Further crawlers hatched in late autumn, overwintered within the egg-masses, fed at the base of the new shoots in early spring and transformed to adults in May. These laid eggs that hatched in June, and the resulting crawlers infested the fruits or the bases of the shoots.

Tests in 1957–58 showed that sprays applied on 27th March, when the crawlers were emerging from their overwintering sites, were preferable to treatments applied in autumn or winter, and that 1 lb. 25 per cent. wettable parathion or diazinon per 100 U.S. gal. gave better control than the other materials tested. In 1959, sprays applied at the pink-bud or petal-fall stages gave better control than those applied in June, when some fruits were already infested; the parathion and diazinon sprays were again the most effective.

Hartenstein (R. C.). **The effects of DDT and malathion upon forest soil microarthropods.**—*J. econ. Ent.* **53** no. 3 pp. 357–362, 2 graphs, 18 refs. Menasha, Wis., 1960.

The investigations described were carried out in 1958 on 24 plots in a plantation of red pine (*Pinus resinosa*) and 24 in a mixed hardwood stand in New York State. Sprays of 1, 10 and 50 lb. DDT and 2 lb. malathion per acre and the solvent used for them were compared with no treatment in four replicates in each environment, and collections of small arthropods from soil cores made twice before and seven times after treatment over a period of a year resulted in data to which an analysis of variance could be applied. About 95 per cent. of the small arthropods extracted from the soil were mites and Collembola, and the normal dose of 1 lb. DDT and the slightly high dose of 2 lb. malathion did not affect them; 10 lb. DDT caused temporary changes in population, and 50 lb. reduced the numbers throughout the year in the pine plantation.

Donley (D. E.). **Field testing of insecticides for control of the Nantucket pine moth, *Rhyacionia frustrana*, and the European pine shoot moth, *R. buoliana*.**—*J. econ. Ent.* **53** no. 3 pp. 365–367, 2 refs. Menasha, Wis., 1960.

Preliminary field tests of insecticides for the control of *Rhyacionia frustrana* (Comst.) and *R. buoliana* (Schiff.) on shortleaf pine (*Pinus echinata*) and red pine (*P. resinosa*), respectively, were made in Ohio in 1957–58, and comparison of the percentages of tips infested on treated and untreated trees indicated that, in 45 U.S. gal. emulsion spray per acre, applied to control larvae in the early instars, 12 oz. Delnav (2,3-p-dioxane S,S-bis(O,O-diethyl phosphorodithioate)), azinphos-methyl (Guthion) or Trithion, 1 lb. methyl-parathion and 2 lb. malathion were effective and at least as good as 7 lb. DDT. Tests on a larger scale are needed before recommendations can be made.

Harein (P. K.). **Effect of ronnel upon the adult rice weevil, *Sitophilus oryza*.**—*J. econ. Ent.* **53** no. 3 pp. 372–375, 1 graph, 7 refs. Menasha, Wis., 1960.

Laboratory tests were made in Kansas in the spring of 1959 to determine the effectiveness of fenchlorphos (ronnel) in protecting stored wheat against adults of *Sitophilus oryzae* (L.). Samples of grain containing about 13 per cent. moisture were shaken with various concentrations of the insecticide in 1 ml. water per 1,797 g. wheat (4 U.S. gal. per 1,000 bushels), exposed to the air for 24 hours and infested with 50 adults per 400 g. After 14 days, the LC50 and LC95 were 1·85 and 4 parts per million, respectively; counts of progeny 35 days later showed that a dosage of 1 p.p.m., which killed only 7 per cent. of the adults, reduced reproduction by about 94 per cent. Exposing the weevils to wheat treated with 2·5 p.p.m. fenchlorphos for 9 and 27 days caused 80 and 93 per cent. mortality, respectively, and exposing them for 14 days to wheat that had been treated with 20 p.p.m. about two months earlier resulted in complete kill. The odour, appearance and texture of the wheat were unchanged by treatment with 5 p.p.m. fenchlorphos, but doses of 10 and 25 p.p.m. affected the odour.

Christensen (C. M.) & Hodson (A. C.). **Development of granary weevils and storage fungi in columns of wheat. II.**—*J. econ. Ent.* **53** no. 3 pp. 375–380, 3 figs., 5 refs. Menasha, Wis., 1960.

The authors give an account of further tests on the relations between *Sitophilus granarius* (L.) and the fungi, particularly *Aspergillus restrictus*, that damage stored grain [*cf. R.A.E.*, A **48** 32, etc.]. The following is based largely on their abstract of it. Seed-grade wheat with a moisture content of 13–14 per cent. was stored in cylinders 8 in. in diameter and 40 in. high, each of which held 23 kg. grain, and 200 adults of *S. granarius* were allowed to move freely through the grain or were caged with 2·4 kg. grain at the bottom of the cylinder. The cylinders were kept at 25°C. [77°F.] and 65–70 per cent. relative humidity, and samples of wheat were withdrawn through side ports after 2, 4 and 6 months and tested for moisture content, fungus population, germination, insect damage and number of insects.

The moisture content of the grain in which the insects moved freely increased to 20 per cent. in the upper part and to some extent throughout the bulk; storage fungi increased greatly, the temperature rose by up to 10·8°F., and two-thirds of the kernels at all levels were damaged. Where the insects were caged at the bottom of the grain, the moisture content increased by as much as 3 per cent. for several inches above them and by 0·5 per cent. in grain 1–2 ft. above them. Storage fungi increased greatly, and the percentage of wheat germinating was reduced almost to zero at the lower level. In cylinders containing no insects, the grain remained essentially unchanged.

Fumigation of the grain with a commercial mixture of carbon tetrachloride, ethylene dichloride and ethylene dibromide at the rate of 4 ml. per bushel for 24 hours killed all the insects, but had no effect on the fungi, which continued to increase.

Yamamoto (R. T.) & Fraenkel (G.). **The suitability of tobaccos for the growth of the cigarette beetle,** *Lasioderma serricorne*.—*J. econ. Ent.* **53** no. 3 pp. 381–384, 12 refs. Menasha, Wis., 1960.

The following is based on the authors' introduction and abstract. Although *Lasioderma serricorne* (F.) infests stored tobacco frequently and sometimes quite heavily, it does not attack all types indiscriminately or with equal intensity, and the relative nutritional and toxic qualities of four tobaccos were compared in the United States with respect to certain growth criteria of the beetle.

The larvae developed well on flue-cured tobacco, very slowly and with high mortality on Turkish and Maryland tobaccos and not at all on burley tobacco; the response had no direct relation to the nicotine contents, which were 1·72, 1·02, 1·56 and 4·17 per cent., respectively. Growth was greatly stimulated by the addition of yeast or B-vitamins, but not by casein, glucose or cholesterol. The major characteristics of insects reared on the various types of tobacco fortified with yeast were optimal growth and survival on flue-cured tobacco; slower growth and smaller adults but good survival on Turkish and Maryland; and slow growth, small adults and high mortality on burley tobacco. Up to 10 per cent. nicotine was well tolerated in a diet of flour and yeast, although 0·1 per cent. was harmful to *Tribolium confusum* Duv. and *Tenebrio molitor* L., but the tolerance was below 4 per cent. in tobacco, suggesting the presence of some further factor increasing toxicity.

It is concluded that the suitability of tobacco for *Lasioderma* depends on its nicotine content, on its nutritional adequacy and on materials that may enhance the toxicity of nicotine.

Munger (F.), Gilmore (J. E.) & Cressman (A. W.). *Citrus* **red mites resistant to demeton and ovex and their response to Tedion and Kelthane.**—*J. econ. Ent.* **53** no. 3 pp. 384–388, 6 figs., 4 refs. Menasha, Wis., 1960.

The following is based on the authors' abstract. Strains of *Panonychus citri* (McG.) that had become resistant to demeton and chlorfenson (ovex) as a result of repeated treatment with sprays of these materials on *Citrus* in California were collected for laboratory rearing and testing. Those resistant to demeton, which were tested by dipping newly emerged females on green lemons in a demeton emulsion, were found to be 163 times as resistant as a normal strain, and those resistant to chlorfenson were 131 times as resistant, as measured by the number that developed to maturity from a given number of eggs on lemons dipped in chlorfenson suspension. Neither strain showed any increase in tolerance to Tedion or Kelthane, but Tedion was about ten times as effective as Kelthane.

Granett (P.) & Reed (J. P.). **Field evaluation of Sevin as an insecticide for pests of vegetables in New Jersey.**—*J. econ. Ent.* **53** no. 3 pp. 388–395, 11 refs. Menasha, Wis., 1960.

The following is substantially the authors' abstract. Tests on a wide range of vegetable crops in New Jersey in 1954–58 showed that wettable-powder sprays containing 0·25–1 lb. Sevin per 100 U.S. gal. controlled *Phyllotreta cruciferae* (Goeze) on cabbage and other crucifers, *Empoasca fabae* (Harris) and *Epilachna varivestis* Muls. on beans, and *Ostrinia* (*Pyrausta*) *nubilalis* (Hb.), *Heliothis zea* (Boddie) and *Spodoptera* (*Laphygma*) *frugiperda* (J. E. Smith) on maize, but was usually somewhat less effective against *Anasa tristis* (Deg.) on cucurbits and *Pieris rapae* (L.), *Trichoplusia ni* (Hb.) and *Plutella maculipennis* (Curt.) on cabbage. It was only moderately effective against *Macrosiphum euphorbiae* (Thos.) (*solanifolii* (Ashm.)) on potato, did not control *Tetranychus telarius* (L.) (*bimaculatus* Harvey) on beans and appeared to favour the increase of *Rhopalosiphum pseudobrassicae* (Davis) on turnip, presumably by destroying parasites and predators. Foliage injury due to the insecticide was not apparent except after repeated spraying of maize in 1956 and 1957; it was not noticed in 1958. In general, Sevin did not appear to have a marked effect on yield or on the flavour of four vegetables tested. Residue analysis on the day of spraying showed varying amounts of active chemical, depending on the crop, but the residues decreased to a relatively low level within a week.

Johnson (R. B.). **The effect of copper compounds on control of** *Citrus* **rust mite with zineb.**—*J. econ. Ent.* **53** no. 3 pp. 395–397, 1 ref. Menasha, Wis., 1960.

Zineb was found in preliminary tests in Florida to give better and more prolonged control of *Phyllocoptruta oleivora* (Ashm.) on *Citrus* than sulphur, but its period of effectiveness was reduced by the inclusion of basic copper sulphate as a fungicide in the same spray. Further tests in 1958 showed that six copper compounds that may be applied to *Citrus* for the control

of fungus diseases reduced the effectiveness of sprays of 0·5–1 lb. 65 per cent. zineb per 100 U.S. gal. against the mite in summer, but not when applied at the post-bloom stage. The prevention of fruit russeting depended on good control of the mite, and two applications of 0·5–1 lb. zineb per 100 U.S. gal. was the only treatment that gave this from 21st April to 10th December; 10 lb. wettable sulphur was better than no treatment, but significantly less effective than zineb. The copper compounds are considered equally effective for disease control, and no satisfactory substitutes for them are known. The mite control given by zineb in sprays containing basic copper sulphate was improved by the inclusion of emulsified oil, but not by parathion.

Stone (M. W.), Foley (F. B.) & Campbell (R. E.). **Field tests with various insecticides for the control of *Lygus* bugs and the corn earworm on lima beans.**—*J. econ. Ent.* **53** no. 3 pp. 397–403, 4 refs. Menasha, Wis., 1960.

The following is based on the authors' abstract. In numerous replicated field tests in which insecticides were applied in dusts and sprays to lima beans in southern California in 1953–59, dieldrin gave the best control of *Lygus* spp., mainly *L. hesperus* Knight, followed in order by toxaphene, endrin, a mixture of DDT and toxaphene and DDT alone, whereas the mixture was the most effective in reducing the pitting of beans by *Lygus* feeding and, followed by dieldrin, endrin and DDT, gave the highest yield of dry beans (4 sacks per acre more than no treatment). Endrin was the most effective material for the combined control of *Lygus* and *Heliothis zea* (Boddie), but toxaphene, the mixture and DDT gave adequate control of both insects and were cheaper. Unless resistance by *Lygus* develops, one application of 2 lb. DDT per acre in spray or dust will give good control if made near the end of the flowering period, and a second, 2–3 weeks later, will reduce damage by *H. zea* and prevent reinfestation by *Lygus*.

Wolfenbarger (D. O.). **Brief history of aphid control on potatoes in South Florida, 1946–59.**—*J. econ. Ent.* **53** no. 3 pp. 403–405, 3 refs. Menasha, Wis., 1960.

The following is based on the author's abstract. Details are given of the results obtained in tests of insecticides applied in sprays for the control of *Myzus persicae* (Sulz.) on potato in southern Florida in the 13 growing seasons between 1945–46 and 1958–59. Emulsion sprays of DDT were effective for about five years and then declined, possibly owing to the development of resistance or tolerance in the aphid, toxaphene was effective in many seasons, but sometimes reduced yields, and parathion, which also controlled other insects attacking potato, gave satisfactory control for about ten years. Thiodan was found to control the aphid at about the time that parathion became ineffective, and is now recommended.

Schread (J. C.). **Systemic insecticides for control of scales, leaf miners, and lace bugs.**—*J. econ. Ent.* **53** no. 3 pp. 406–408, 3 refs. Menasha, Wis., 1960.

Systemic insecticides were further tested in 1959 for the control of insects attacking ornamental plants in Connecticut [*cf. R.A.E.*, A **48** 468, etc.]. Phorate and mevinphos (Phosdrin) gave complete control and were much more effective than Di-Syston (O,O-diethyl S-2-(ethylthio)ethyl phosphorodithioate) or Sytam (schradan) against *Asterolecanium* sp. when applied in

drenches to the soil round holly [*Ilex opaca*] in pots on 19th July, but phorate granules raked into the soil under young pine trees did not give good control of *Phenacaspis pinifoliae* (Fitch). In further tests of granules applied to the soil, a side dressing to rows of birch trees of 12–48 lb. dimethoate or 12–36 lb. phorate per acre gave good control of *Fenusa pusilla* (Lep.), with the former the more effective against the first generation and the latter against the second, and treatment with 0·012–0·025 oz. dimethoate per plant on 23rd July and 0·05 oz. per plant on 15th July gave complete control of *Phytomyza ilicicola* Lw. (*ilicis*, auct.) on *I. opaca* and *Monarthropalpus buxi* (Lab.) on box (*Buxus sempervirens*), respectively, but phosphamidon was ineffective against all three species. When applied in granules and watered in, dimethoate gave good control of *Stephanitis rhododendri* Horv. on rhododendrons, *S. globulifera* (Mats.) on andromeda (*Pieris japonica*) and *S. pyrioides* Scott on azaleas, and phosphamidon was effective against the last two.

Gannon (N.) & Decker (G. C.). **The excretion of dieldrin, DDT, and heptachlor epoxide in milk of dairy cows fed on pastures treated with dieldrin, DDT, and heptachlor.**—*J. econ. Ent.* **53** no. 3 pp. 411–415, 3 graphs, 12 refs. Menasha, Wis., 1960.

In experiments in 1957–58, dairy cows were allowed to graze on pasture that had been sprayed with 0·5 lb. dieldrin or heptachlor or 3 lb. DDT per acre, which are about twice the dosages normally applied. When the cows were allowed into the pasture immediately after treatment, the concentrations in the milk reached 3–4 parts per million for dieldrin, 0·22 p.p.m. for heptachlor (as heptachlor epoxide) and 7–8 p.p.m. for DDT in 3–7 days and then declined steadily. The dieldrin content of milk from cows that entered the treated pasture after 3–7 days also tended to reach a peak after three days and then to decline, but that from cows kept out until the 14th–21st day, when the residue on the vegetation had dropped to about 0·2 p.p.m., did not reach a peak for about three weeks. A cow that was in the treated pasture for only the first three days showed nearly twice as much dieldrin in the milk after 50 days as did one that was kept on it from the 15th to the 50th day.

Knipling (E. F.). **Use of insects for their own destruction.**—*J. econ. Ent.* **53** no. 3 pp. 415–420, 10 refs. Menasha, Wis., 1960.

The author discusses four possible methods of using insects to eliminate their own species from a region. They comprise the release of males rendered sterile by γ-radiation, which has proved successful in one species [*cf. R.A.E.*, B **44** 103–104], and the use of chemicals to produce sexual sterility in the natural population [*cf.* B **47** 139], the release of adults infected with pathogens that would destroy larval progeny, and the release of insect strains that carry deficient genetic characteristics [*cf.* A **49** 80], which have not been tested.

Fronk (W. D.) & Painter (L. I.). **Some characteristics of alkali bee nesting sites.**—*J. econ. Ent.* **53** no. 3 pp. 424–425, 1 graph, 6 refs. Menasha, Wis., 1960.

The following is based on the authors' abstract. *Nomia melanderi* Ckll. is an important pollinator of lucerne in Wyoming, but the numbers of nesting

sites and of bees per site have recently declined in the Riverton seed-producing area. In an attempt to determine what makes sites attractive to the bees, soil samples from several nesting and non-nesting areas were analysed and the moisture contents determined throughout summer and early autumn. In general, the selection of a particular site seemed to depend at least partly on suitable texture and moisture conditions; a soil of sand, silt and clay (75:17:8) with a constant moisture content of about 13 per cent. seemed to be required. Other chemical and physical differences between nesting and non-nesting areas were associated with variations in soil moisture. The presence of a few plants encouraged nesting, but was not essential.

Adkisson (P. L.), Wilkes (L. H.) & Cochran (B. J.). **Stalk shredding and plowing as methods for controlling the pink bollworm,** *Pectinophora gossypiella*.—*J. econ. Ent.* **53** no. 3 pp. 436–439, 10 refs. Menasha, Wis., 1960.

The following is based on the authors' abstract. Several types of stalk-shredding machines were tested for their efficiency in destroying larvae of *Pectinophora gossypiella* (Saund.) persisting in unpicked cotton bolls after harvest in central Texas in 1958. Kills of up to 88 per cent. were obtained, depending on the type of machine used; a flail chopper gave the best results, and the conventional rotary stalk shredders the worst. Burying the plant débris, by ploughing or otherwise, killed 76–83 per cent. of the larvae, whereas an average of 51·6 per cent. survived when the infested material was left on the soil surface throughout the winter. It is concluded that stalk shredding and ploughing soon after harvest, if practised by the whole community, would drastically reduce the threat of infestation in the following year.

Snapp (O. I.). **Soil treatments in lieu of spraying for plum curculio control in peach orchards.**—*J. econ. Ent.* **53** no. 3 pp. 439–441, 3 refs. Menasha, Wis., 1960.

In further tests in Georgia in which first-generation larvae of *Conotrachelus nenuphar* (Hbst.) were allowed to pupate in boxes of soil that had been treated with insecticide [*cf. R.A.E.*, A **46** 343, etc.], 2–4 lb. aldrin or dieldrin per acre in dusts continued to prevent adult emergence after eight years, heptachlor at 4 lb. in a dust and 2 lb. in granules after seven and four, respectively, 4 lb. aldrin in granules or emulsion concentrate after six, and 4 lb. chlordane in granules after five; 2 lb. endrin in granules and 2–5 lb. Thiodan in dusts, applied in April in 1958 and 1959, respectively, seemed much less effective. No differences due to formulation were found.

Treating peach orchards with 2·3 lb. aldrin per acre in 2 per cent. granules, scattered on the soil by hand and harrowed in on the same day in March 1957, reduced the percentage of harvested peaches infested to 1·6, 2·9 and 0·7 in 1957, 1958 and 1959, respectively, without the application of insecticides to the trees; only small numbers of adults were jarred from the trees during these years. In another orchard, similar treatment with 2 lb. aldrin per acre in January 1956 prevented the development of adults from most of the larvae that were caged under trees in May 1957 or 1958 or June 1959 [*cf. loc. cit.*]. Soil treatment with aldrin, dieldrin or heptachlor is now used with success as a supplement to spraying in some peach orchards in Georgia.

Taschenberg (E. F.) & Avens (A. W.). **Parathion and EPN residue studies on Concord grapes.**—*J. econ. Ent.* **53** no. 3 pp. 441–445, 4 graphs, 21 refs. Menasha, Wis., 1960

As parathion and EPN have given satisfactory results in New York when used to replace DDT in some or all of a schedule of three sprays against *Paralobesia viteana* (Clem.) on vines [*cf. R.A.E.*, A **41** 266; **46** 342], the rate of loss of the residues from the grapes was studied during the three weeks after the last application. The deposits from sprays of 2 lb. 15 per cent. parathion or 27 per cent. EPN per 100 U.S. gal. were reduced by 94·1 and 64·2 per cent., respectively, during the week after the second of two applications in 1951, and similar results were obtained in 1952, when the residues were below 1 part per million two and about three weeks, respectively, after the last of three sprays of parathion and EPN containing similar amounts of toxicant. The presence of hydrated lime in the spray mixture did not appreciably increase the rate of loss. Difficulties in the chemical determination of the residues are discussed.

Woodside (A. M.). **Further studies on control of the clover root borer in Virginia.**—*J. econ. Ent.* **53** no. 3 pp. 449–450, 1 ref. Menasha, Wis., 1960.

Investigations on the control of *Hylastes* (*Hylastinus*) *obscurus* (Marsham) on red clover [*Trifolium pratense*] in Virginia [*cf. R.A.E.*, A **45** 432] were continued in 1955–58 to determine the most satisfactory insecticide and lowest effective rate of application. The results showed no significant difference between 1 lb. heptachlor or γ BHC or 2·5 lb. chlordane per acre in granules or between applications in autumn, late winter or spring in 1955–56, all of which were very effective, but sprays of BHC and sprays and dusts of heptachlor gave rather less protection than granules. In granules, 0·6 lb. heptachlor, 1 lb. γ BHC or 0·7 lb. aldrin per acre remained effective for one season, 1 lb. heptachlor for two and 2 lb. heptachlor for three seasons.

Matsumura (F.). **Malathion residues on and in the leaves of** *Phaseolus vulgaris*.—*J. econ. Ent.* **53** no. 3 pp. 452–454, 3 graphs, 10 refs. Menasha, Wis., 1960.

In the laboratory experiments described, malathion labelled with ^{32}P was used to show the rate at which the compound and its metabolites are translocated in the tissues of *Phaseolus vulgaris*. Examination of whole bean plants five days after the injection of radioactive malathion into the stem, 3 cm. above soil level, showed counts of 2,791·7 per minute per g. tissue at the injection point, 326·3 in the root, 79·7–101 higher in the stem and 167, 142 and 22·7 in the growing point, terminal leaf and simple leaf, respectively, indicating that the speed of translocation varies in the different parts. When drops of radioactive malathion in acetone were put on the surface of a simple leaf, initial absorption was almost complete in ten minutes, and the total amount of radioactivity in and on the leaf was shown to decrease very rapidly for three days, owing largely to evaporation of the initial deposit, after which it decreased very slowly, because most of the compound remaining had been absorbed into the leaf, where translocation is slow and evaporation prevented.

Daniels (N. E.). **Evidence of the oversummering of the greenbug in the Texas Panhandle.**—*J. econ. Ent.* **53** no. 3 pp. 454–455, 4 refs. Menasha, Wis., 1960.

The author lists 20 species of grasses, five not previously recorded as food-plants of the aphid, on which *Toxoptera graminum* (Rond.) was observed to reproduce in Texas in 1953–59 [*cf. R.A.E.*, A **43** 432]. The aphid was found on wheat until May–June and after August–October, and both the normal and aestivating forms occurred on *Agropyrum smithii* during the summer of 1959, migrating to large clumps of self-sown wheat in late summer and from these to wheat fields in the autumn. It is evident that the aphid survives the summer on *A. smithii*, in either the normal or the aestivating form, according to the degree of drought. Eggs [*cf.* **45** 363] have not been observed in the field.

Powell (J. D.) & Floyd (E. H.). **The effect of grain moisture upon development of the rice weevil in green corn.**—*J. econ. Ent.* **53** no. 3 pp. 456–458, 1 graph, 6 refs. Menasha, Wis., 1960.

Tests were carried out in 1956 and 1958 to determine the maximum moisture content of the grain at which oviposition followed by complete development of the greater rice weevil, *Sitophilus oryzae* (L.), takes place on maize in the field in southern Louisiana [*cf. R.A.E.*, A **48** 459]. It was found that eggs were laid at 65 but not at 75 per cent. moisture content; they hatched nine days later, when the moisture content had fallen to 48 per cent., and the first pupae and adults were found after 37 and 42 days, the final moisture content being about 25 per cent.

Wilford (B. H.). **Forest-insect surveys in the central Rocky Mountains.**—*J. econ. Ent.* **53** no. 3 pp. 458–462, 4 figs. Menasha, Wis., 1960.

The following is substantially the author's abstract. With the growth of forestry, survey methods have been developed to detect and appraise forest-insect infestations, and such surveys are important for forest protection in the central Rocky Mountains area of the United States. Outbreaks are discovered through field surveillance or by means of systematic aerial and ground surveys, after which an inspection of the infestation may be made by an entomologist to determine the need for an appraisal survey. The latter is divided into an entomological measurement of the potential threat of the infestation and a systematic cruise of the area to obtain information for control planning. The objectives of the programme are to allow no outbreaks to escape early discovery and, upon discovery, to obtain information about the insect concerned, where it is, what it is doing, its potentialities, methods for control and data directly concerned with control.

Brunson (M. H.). **Laboratory studies on the toxicity of various insecticides to different stages of the oriental fruit moth.**—*J. econ. Ent.* **53** no. 3 pp. 468–471, 2 refs. Menasha, Wis., 1960.

The author describes methods developed and used in New Jersey in 1952–57 for testing large numbers of insecticides against *Cydia* (*Grapholitha*) *molesta* (Busck) in the laboratory to find those most suitable for further testing in peach orchards. Sprays, usually at five concentrations, were

applied to the eggs and adults and to leaves across which newly-hatched larvae were induced to crawl, and the mortalities obtained were compared with those given by parathion, which was used as the standard. The results given by 54 compounds showed that azinphos-methyl (Guthion), parathion, methyl-parathion, Chlorthion, EPN and Sevin were the most and ryania, Tedion, ethyl-DDD (Perthane) and methoxy-DDT (methoxychlor) the least effective against all stages; most materials were more toxic to adults than to the immature insects. Some of the materials that were effective in the laboratory were less so in concurrent orchard tests, but none was more effective in the orchard than in the laboratory.

PARKER (H. L.). **Starvation tests with larvae of the cinnabar moth.**—*J. econ. Ent.* **53** no. 3 pp. 472–473, 1 ref. Menasha, Wis., 1960.

Preliminary laboratory tests were carried out in France to find whether *Tyria jacobaeae* (L.) might safely be introduced into the United States for the biological control of ragwort (*Senecio jacobaea*). When larvae in the early instars were caged with parts of various plants, they failed to complete their development on artichoke (*Cynara scolymus*), *Aster*, *Cosmos*, *Chrysanthemum leucanthemum* (*Leucanthemum vulgare*), *Lonicera*, *Calendula*, safflower (*Carthamus tinctorius*) or hops; field-collected larvae in later instars did not feed on strawberry leaves, but some pupated on *C. tinctorius* and *Zinnia*, probably completing their development on reserves accumulated during earlier feeding on ragwort.

MEDLER (J. T.) & SMITH (P. W.). **Greenbug dispersal and distribution of barley yellow dwarf virus in Wisconsin.**—*J. econ. Ent.* **53** no. 3 pp. 473–474, 1 map, 4 refs. Menasha, Wis., 1960.

Surveys and enquiries in Wisconsin in 1959 indicated that *Toxoptera graminum* (Rond.) was unusually abundant in oat fields and common enough to require insecticidal treatment over about 20,000 acres in 18 counties. The aphid does not overwinter in Wisconsin, but is dispersed by wind from its areas of normal distribution in the south, and the combination of factors responsible for the outbreak is discussed. They included cold weather in April, which delayed the planting of oats, and high temperature and strong southerly winds in early May, which encouraged aphid migration in the Middle West. Towards the end of June, heavy showers, maturing of the grain and attack by predators reduced populations. The yellow-dwarf virus disease was much more prevalent in the crop than usual in Wisconsin, probably owing to the wide occurrence of *T. graminum*, though some virus was undoubtedly spread by other vectors [*cf. R.A.E.*, A **43** 268] that were common in 1959. Treatment with malathion or parathion in early June reduced aphid populations in some heavily infested fields, but the virus continued to cause serious injury.

TOMLINSON jr. (W. E.). **Currant fruit weevil, *Pseudanthonomus validus*, a pest of cultivated highbush blueberry.**—*J. econ. Ent.* **53** no. 3 pp. 474–475, 1 fig., 4 refs. Menasha, Wis., 1960.

Larvae of *Pseudanthonomus validus* Dietz were found in the fruits of cultivated high-bush blueberry in Massachusetts in 1953, and the weevil has since been observed in all the blueberry fields examined in south-eastern

Massachusetts. Most infestations were very light, but the crop was reduced considerably in one field in 1958. The life-history and habits of the insect are similar to those recorded in Maine [*R.A.E.*, A **4** 263], but the season in Massachusetts is 10–14 days earlier. Adult activity and oviposition are greatest on warm days in late May and early June and oviposition occurs mainly in the stem end of the berry or in the berry stem. In the latter case, the newly hatched larva tunnels up the stem and into the berry to finish feeding. Excellent control was given in 1959 by an application of 3 oz. dieldrin per acre by aeroplane just before the early varieties of blueberry flowered.

Polivka (J. B.). **Effect of lime applications to soil on Japanese beetle larval population.**—*J. econ. Ent.* **53** no. 3 pp. 476–477, 3 graphs, 1 ref. Menasha, Wis., 1960.

Further investigations on the effect of soil pH on larval populations of *Popillia japonica* Newm. [*cf. R.A.E.*, A **41** 87] were made in Ohio in 1950–57. Surveys showed that there were 2–10 times as many larvae in acid soils (pH 4·3) as in those that had been treated with hydrated lime in about 1940 (pH 7), and lower populations were found in the autumns of 1954–57 in plots that had been treated with 1,500 lb. lime per acre in April 1954 than in untreated ones. In soil treated with 0, 1,500 and 3,000 lb. lime in 1954, pH values of 5·7, 6·6 and 7·1 were found in 1957, and populations were highest in the first and lowest in the third throughout the period of test. Parallel fluctuations in population in limed and unlimed plots from year to year were considered to be due to differences in weather.

Strong (F. E.), Wells (K.) & Apple (J. W.). **An unidentified fungus parasitic on the seed-corn maggot.**—*J. econ. Ent.* **53** no. 3 pp. 478–479, 3 figs., 10 refs. Menasha, Wis., 1960.

Adults of *Hylemyia cilicrura* (Rond.) collected in Wisconsin between 22nd May and 5th August 1957 and again in early 1958 were found to be attacked by an unidentified internal fungus. It infested both sexes and appeared to cause complete sterility without affecting behaviour. Histological examination of two diseased flies, preserved in cotton-wool, suggested that it belongs to the Entomophthoraceae. Similar infestation has been reported in a related species [*R.A.E.*, A **15** 648].

Kerr (T. W.) & Olney (C. E.). **Laboratory studies of three-lined potato beetle and control with various insecticides.**—*J. econ. Ent.* **53** no. 3 pp. 480–481, 2 refs. Menasha, Wis., 1960.

Lema trilineata (Ol.), which was formerly of no importance on potato in Rhode Island, became increasingly injurious after the replacement of DDT by dieldrin for the control of *Epitrix cucumeris* (Harris) in 1956, and the reasons for the increase were investigated in 1959, when damage was severe in some fields. The beetle was found to have two generations a year, overwintered adults being present from late May until mid-July and those of the first generation appearing in mid-July and ovipositing in early August. Examples collected from a field in which dieldrin had been used for three years were exposed to deposits from acetone solutions of DDT, dieldrin or Thiodan in jars for 48 hours. Deposits of 360 and 281 μg. dieldrin per sq. in. killed less than 1 per cent. of overwintered and summer adults, respectively.

The LD50 of DDT was about 5 μg. per sq. in. against overwintered adults and rose from 22·5 to 515 μg. against the first generation between 30th July and 12th August, and that of Thiodan rose from 0·31 μg. per sq. in. in early July to 8 μg. in mid-August; it is noted that field application of 0·75 lb. Thiodan per acre resulted in a deposit of 2 μg. per sq. in. of potato foliage immediately afterwards. Endrin residues were tested by exposing overwintered adults to them for 72 hours, but gave erratic results.

It is concluded that *L. trilineata* increased because dieldrin was ineffective against it and that, although DDT and Thiodan would control overwintered adults at ordinary dosages, they might fail against the first generation.

Hardin (L. J.), Stanley (W. W.), Gonzalez (D. E.) & Bennett (S. E.). **Sevin residues on soybeans following its use for armyworm control.**—*J. econ. Ent.* **53** no. 3 pp. 481–482, 1 ref. Menasha, Wis., 1960.

Wettable Sevin was applied at 0·75, 1·5 and 3 lb. per acre to replicated plots in a field of soy beans infested by *Pseudaletia unipuncta* (Haw.) in eastern Tennessee in August 1959 and resulted in populations of 4·3, 5·3 and 4 larvae per sq. ft. of plot after 24 hours and 1·3, 1·2 and 0·1 after 96, as compared with 8·5 and 9·6, respectively, on untreated plots. Analysis of extracts of the plants showed Sevin residues of 24, 78 and 125 parts per million immediately after application and 2, 4 and 30 p.p.m. after 96 hours, as compared with 0·6 and 0·8 p.p.m. in untreated ones, and it is concluded that the highest dosage would give practically complete kill of the armyworm, with a residue below 10 p.p.m. (the tolerance established for beans) about a week after application.

Roberts (J. E.) & Anderson (L. E.). **Pickleworm control and residue studies with malathion and Phosdrin.**—*J. econ. Ent.* **53** no. 3 pp. 482–483, 4 refs. Menasha, Wis., 1960.

As cucumbers are usually picked at intervals of 2–3 days and repeated applications of insecticide are necessary for the control of *Diaphania nitidalis* (Stoll) on them in Georgia [*cf. R.A.E.*, A **46** 14], insecticides with a short life are necessary for residues to be below the legal tolerances. Malathion and mevinphos (Phosdrin) were compared for insecticidal effect and rate of disappearance of residue in 1959. Malathion was applied at 1·5 lb. per acre in a 4 per cent. dust and mevinphos at 0·5 lb. per acre in a 2 per cent. dust, four times between 25th June and 24th July, and cucumbers were picked nine times between 1st and 20th July. The numbers of fruits damaged by *D. nitidalis* were significantly lower on treated than on untreated plots on five of the nine dates and throughout the period as a whole, and analysis of cucumber samples 2½ hours after treatment showed that residues of mevinphos were below the legal tolerance of 0·25 part per million and those of malathion too small to be measured.

Hassett (C. C.), Kirk (R.) & Craig (G. B.). **Apparatus for insecticide assay.**—*J. econ. Ent.* **53** no. 3 p. 483, 1 fig., 2 refs. Menasha, Wis., 1960.

The authors describe modifications in a method for the bioassay of insecticides by means of larvae of *Aëdes aegypti* (L.) [*cf. R.A.E.*, A **44** 127, etc.]. The trough, 12 in. long and 3 in. wide, is made of Lucite, and has a standard

40-watt lamp mounted 2 in. beyond one end and a mesh gate in the interior 2·5 in. from the same end; 20 larvae in 250 ml. of the chosen concentration of insecticide are kept for 24 hours at 25°C. [77°F.] and then poured in behind the gate. When the solution is level, the gate is raised and the light turned on, and larvae that do not swim past a mark half way along the trough in one minute are considered dead. Lucite absorbs insecticides, but neither this nor the heating of the water has any significant effect in one minute.

Huddleston (E. W.) & Gyrisco (G. G.). **Residues of Sevin and 1-naphthol on forage from aerial applications of Sevin in oil.**—*J. econ. Ent.* **53** no. 3 p. 484. Menasha, Wis., 1960.

Sevin showed promise for the control of the gipsy moth [*Lymantria dispar* (L.)] in preliminary laboratory and field tests, and the residues on forage crops after applications of 1 lb. Sevin in 1 U.S. gal. kerosene per acre by aeroplane were therefore investigated in New York in 1958. The spray was applied on 30th July to plots in two fields outside the infested area, one predominantly red clover [*Trifolium pratense*] and the other mainly grass, and foliage samples were taken immediately before and after spraying and 1–49 days later. Chemical analysis showed Sevin residues of about 30–35 parts per million immediately after treatment; these fell to about 14–16 p.p.m. after one day and 0·3–0·97 p.p.m. after 14, and were below the sensitivity of the analytic method (0·2 p.p.m.) after 21 days. Quantities of α-naphthol were below the sensitivity of the analysis (0·23 p.p.m.) throughout the period of test, either because little or none was formed or because it was lost very rapidly.

Kieckhefer (R. W.) & Medler (J. T.). **Toxicity of cellulose acetate sheeting to leguminous plants.**—*J. econ. Ent.* **53** no. 3 p. 484. Menasha, Wis., 1960.

In 1959, cages of cellulose acetate, used to confine *Empoasca fabae* (Harris) on broad bean (*Vicia faba*) or lucerne in the greenhouse, caused damage that killed the plants within about two weeks, and K. Maramorosch, after a similar occurrence, identified the toxic component as diethyl phthalate, which is generally employed as the plasticiser in the manufacture of cellulose-acetate sheets. A vinyl plastic proved to be satisfactory in subsequent tests.

Allen (W. R.), Askew (W. L.) & Schreiber (K.). **Relation of sugar-beet root maggot control by insecticides to sugar beet yield.**—*J. Amer. Soc. Sug. Beet Tech.* **10** no. 4 pp. 330–334, 4 refs. Fort Collins, Colo., 1959.

Tests were carried out at Altona, Manitoba, in 1957 on the control of the larvae of *Tetanops myopaeformis* (Röder) attacking sugar-beet [*cf. R.A.E.*, A **46** 123, etc.]. The following is based on the authors' summary of the results. Beet yields were increased by 2–3 tons per acre by applications of heptachlor or aldrin in fertiliser mixtures containing 1 lb. toxicant per acre. Yields were increased by seed treatment with heptachlor, but not with aldrin or dieldrin, at 1 lb. per 100 lb. seed. Seedling stand was reduced significantly by all treatments, but the differences were removed by thinning. The numbers of larvae of *T. myopaeformis* per plant were significantly reduced by the fertiliser-insecticide mixtures, but not by the seed treatments. Reduction in the number of larvae was associated with an increase in the yield and size of the beets, but the sugar content was not affected.

Pickford (R.). **Survival, fecundity, and population growth of** *Melanoplus bilituratus* **(Wlk.) (Orthoptera: Acrididae) in relation to date of hatching.** —*Canad. Ent.* **92** no. 1 pp. 1–10, 3 graphs, 10 refs. Ottawa, 1960.

The following is based almost entirely on the author's summary. Field cage experiments, in which *Melanoplus bilituratus* (Wlk.) was reared from hatching until the end of the season, carried out in Saskatchewan in 1956–58, demonstrated the close relation of the date on which the grasshoppers hatch to population growth; those that hatched in May showed population increases up to ten times as great as those that hatched 7–9 weeks later, in July. Population growth depended primarily on nymphal and adult survival and adult life-span and fecundity. Nymphal survival was consistently higher in the grasshoppers that hatched earliest in the season. The most vulnerable stage in the whole life-cycle appeared to be the very early nymphal stage. When unfavourable weather occurred during this period, populations were greatly reduced. Adult survival during the first two months following the last moult did not appear to be influenced by the date of hatching; during this period the mortality rate was lower than that during any other stage, and, in addition, the adults proved able to withstand fairly extended periods of cool weather during autumn. Fecundity was invariably highest when hatching occurred early in the season; females in one cage of the earliest-hatched group in 1958 laid an average of 22·7 egg-pods each, the highest ever recorded for *M. bilituratus* reared under field conditions. This high fecundity was due to the longer adult life and to a higher rate of oviposition. The rate of oviposition, in terms of the number of eggs produced per female-day, was highest about midsummer, when temperatures were at their maximum. The decline in the rate towards the end of the season was due mainly to the declining temperatures and not to the age of the females. Females were able to oviposit almost to the end of October, even though temperatures had fallen considerably. The date of hatching appeared to have no effect on the size of the egg-pods or the ability of the eggs to hatch. Successive increases in the population growth indices of the grasshoppers reared in field cages occurred from 1956 to 1958. Similar increases over the same period occurred in field populations of *M. bilituratus* throughout Saskatchewan. It is suggested that warmer and drier weather was primarily responsible.

Raine (J.). **Life history and behavior of the bramble leafhopper,** *Ribautiana tenerrima* **(H.-S.) (Homoptera: Cicadellidae).**—*Canad. Ent.* **92** no. 1 pp. 10–20, 23 figs., 17 refs. Ottawa, 1960.

The following is taken almost entirely from the author's summary. *Typhlocyba* (*Ribautiana*) *tenerrima* H.-S., which was first found in North America near Victoria, British Columbia, in 1947 [*R.A.E.*, A **39** 55], has become a serious pest of raspberry and related cane fruits. Characters distinguishing the nymphs from those of *T.* (*Edwardsiana*) *rosae* (L.), which is often found with *T. tenerrima*, are described. Observations on loganberry showed that there are two generations each year, winter being passed mainly in the egg stage in the canes. First-generation nymphs hatch in early May, and adults appear in late May and early June. Eggs are laid in the leaves, petioles and lateral stems of the fruiting canes from late June until early September. Second-generation nymphs appear in late July and early August, the adults during late August and early September. Eggs are laid in the new canes in late September and throughout October. The adult females tend to outlive the males, and sometimes survive until the following March if the winter is mild. Mating occurs on the undersides of the leaves 6–15 days after transformation. The preoviposition period lasts about 20 days, and the incubation

period of the summer eggs is 28 days. The average number of eggs laid by seven first-generation females was 40. First-generation female nymphs require an average of 36 days to complete their development; second-generation males require 33 days, and the females 37 days. Spiders prey on the adults; *Mymar* (*Anaphes*) sp. parasitises the eggs.

Lejeune (R. R.). **Spraying operation for control of the black-headed budworm, Vancouver Island, British Columbia, 1957.**—*Proc. ent. Soc. B. C.* **56** pp. 16–18, 3 refs. Kamloops, B.C., 1959.

An account is given of a large-scale operation in which a spray of DDT in oil was applied by aeroplane in June 1957 to western hemlock [*Tsuga heterophylla*] in Vancouver Island for the control of an outbreak of the black-headed budworm [*Acleris variana* (Fern.)]. Complete control was obtained when the spray deposits were sufficient, and it was found that an average control of 90 per cent. sufficed to prevent severe defoliation. As little as 0·5 lb. DDT in 1 U.S. gal. per acre was effective, but 1 lb. was normally used. Some mortality of fish resulted, in spite of precautions.

Forbes (A. R.) & MacCarthy (H. R.). **Control of aphids and caterpillars on brussels sprouts in British Columbia.**—*Proc. ent. Soc. B. C.* **56** pp. 33–39, 4 figs. Kamloops, B.C., 1959.

Eight insecticides were tested at Vancouver in 1958, in sprays except where noted, for the control of insects on brussels sprouts. Di-syston [O,O-diethyl S-2-(ethylthio)ethyl phosphorodithioate], in granules applied round the base of the plants at 1 lb. toxicant per acre, proved outstanding against *Brevicoryne brassicae* (L.), but had little effect on *Myzus persicae* (Sulz.), which was confined to the old leaves. Demeton (Systox) and dimethoate were promising against *B. brassicae*, and mevinphos (Phosdrin) was effective, but had to be applied five times. Dimethoate and Am. Cyanamid 18706 [O,O-dimethyl S-ethylcarbamoylmethyl phosphorodithioate] at 1 lb. per acre were the best materials against *M. persicae*. Lepidopterous larvae (*Pieris rapae* (L.), *Plutella maculipennis* (Curt.) and *Trichoplusia ni* (Hb.)) were best controlled by mevinphos and malathion at 0·45 and 1·25 lb. per acre, respectively.

Downing (R. S.). **Sevin as an orchard insecticide in British Columbia.**—*Proc. ent. Soc. B. C.* **56** pp. 41–45, 4 refs. Kamloops, B.C., 1959.

In tests in British Columbia in 1957–58, a wettable powder containing 50 per cent. Sevin was used in sprays and gave good control of *Spilonota ocellana* (Schiff.) and *Archips argyrospilus* (Wlk.) when applied at 1·5 lb. per 100 gal. or 8 lb. per acre to apple at the pink-bud stage, of *Eulecanium* (*Lecanium*) *coryli* (L.) and *E.* (*L.*) *cerasifex* (Fitch) when applied at 8 lb. per acre to peach and apricot at the pink-bud stage, of *Anarsia lineatella* Zell. when applied at 1·5 lb. per 100 gal. to apricot at the pink-bud stage, of *Cydia* (*Carpocapsa*) *pomonella* (L.) and *Aphis pomi* Deg. when applied to apple at 6 lb. per acre three or more times during the summer, and of *Psylla pyricola* Först. on pear when applied at 12 lb. per acre in summer.

Williams (K.). **Persistence of Sevin and diazinon residues on fruits.**—*Proc. ent. Soc. B. C.* **56** pp. 57–59, 4 refs. Kamloops, B.C., 1959.

The following is based on the author's summary. Data are given showing the residues of diazinon on cherries and apples and Sevin on apples after the application of sprays in British Columbia Diazinon residues on cherries were similar for a wettable-powder and an emulsion formulation. The addition of a surface-active agent to either insecticide did not affect the magnitude of the initial residues on apple or their persistence. On apple, Sevin residues were more persistent than diazinon residues.

Marshall (J.). **Resistance to DDT in the codling moth in British Columbia.**—*Proc. ent. Soc. B. C.* **56** pp. 59–63, 2 figs., 8 refs. Kamloops, B.C., 1959.

DDT, which formerly gave good control of *Cydia* (*Carpocapsa*) *pomonella* (L.) on apple in British Columbia, gave poor results in 1952, and a definitely resistant strain of the moth was shown to have developed in an orchard near Kelowna in June 1958. Laboratory observations on it are recorded.

Spencer (G. J.). **Outbreaks of granary weevils in homes.**—*Proc. ent. Soc. B. C.* **56** pp. 63–64. Kamloops, B.C., 1959.

Two instances are recorded of the occurrence of large numbers of adults of *Sitophilus granarius* (L.) in houses in British Columbia [*cf.* also *R.A.E.*, A **49** 277]; no source could be detected.

Marshall (J.). **An unusual manifestation in the natural control of the pear Psylla,** *Psylla pyricola* **Foerst.**—*Proc. ent. Soc. B. C.* **56** pp. 69–71, 2 figs., 3 refs. Kamloops, B.C., 1959.

The following is based on the author's summary. In the semi-arid Okanagan Valley of British Columbia, *Psylla pyricola* Först. has not usually been so serious a pest of pear as in more humid areas. In 1958, hot, dry weather proved injurious to it. The freely moving fourth- and fifth-instar nymphs were killed, presumably by desiccation, and nymphs in the earlier instars died as a result of the solidification of the honeydew within which they feed. The only predator present, *Anthocoris antevolens* White, was of minor importance.

Ayre (G. L.). **Food habits of** *Formica subnitens* **Creighton (Hymenoptera: Formicidae) at Westbank, British Columbia.**—*Insectes Sociaux* **6** no. 2 pp. 105–114, 3 graphs, 7 refs. Paris, 1959. (With a summary in German.)

The following is virtually the author's summary. Investigations in an uncultivated field at Westbank, British Columbia, in 1955 showed that *Formica subnitens* Creighton obtained its food from two primary sources, animal tissues and liquids containing sugar. Animal tissues were of insects, and those that formed the largest part of the diet of the ants were other ants, Coleoptera, and Lepidoptera. Hemiptera, Homoptera and Orthoptera were

taken in lesser numbers. The number of insects captured per day varied with the number of ants foraging, but the number captured throughout the summer depended on the requirements of the ant brood. The ants used plant secretions from May to early June as a source of sugar. From June to September, they collected honeydew from 10 species of aphids and a Membracid.

Metcalfe (J. R.). **A preliminary reassessment of** *Diatraea saccharalis* **(F.) in Barbados, West Indies.**—*Trop. Agriculture* (*Trin.*) **36** no. 3 pp. 199–209, 7 graphs, 9 refs. London, 1959.

In Barbados, *Trichogramma minutum* Ril. is liberated each year in large numbers for the control of *Diatraea saccharalis* (F.) on sugar-cane. A survey to assess the current effectiveness of the programme was begun in 1958. Estimation of the infestation rate from counts made in factory yards showed that an average of 12·35 per cent. of internodes was infested, but the results were subject to considerable error. Differences between cane varieties were significant, but not those between fields in which *Trichogramma* was or was not released or between ratoons and plant cane. Weekly oviposition by *Diatraea* and the natural *Trichogramma* population were investigated by methods that are described, and it is shown that the parasite population is now much greater than it was in 1929, when liberations began [*cf. R.A.E.*, A **22** 539, etc.], so that parasitism of the eggs is little increased by liberation of further parasites.

Breese (M. H.). **The development and oviposition of** *Oryzaephilus* **spp. on unrefined sugars.**—*Bull. ent. Res.* **52** pt. 1 pp. 7–16, 3 graphs, 8 refs. London, 1961.

The following is virtually the author's summary. Experiments were conducted in Trinidad with locally collected strains of *Oryzaephilus surinamensis* (L.) and *O. mercator* (Fauv.), the average sizes of which were smaller than those given in the literature. Limited observations on their bionomics on cereal products showed that whereas the egg-production of *O. mercator* was comparable with that recorded by other workers under similar conditions [*cf. R.A.E.*, A **44** 410], that of *O. surinamensis* was much lower [*cf.* **14** 634; **44** 410]. Larvae of both species were able to complete their development on raw and yellow-crystal sugar, but there was a high mortality among those of *O. surinamensis*. Both species showed very low oviposition rates on sugar, and this, together with a high larval mortality, would indicate that infestations of *O. surinamensis* on these products would die out. *O. mercator*, on the other hand, could multiply very slowly. Oviposition rates rose rapidly when females were returned from sugar to cereal products. Unrefined sugars should accordingly not be disregarded as sources of infestation by *Oryzaephilus*, especially in the humid tropics.

Crowe (T. J.), Jones (G. D. G.) & Williamson (R.). **The use of pyrethrum formulations to control** *Antestiopsis* **on coffee in East Africa.**—*Bull. ent. Res.* **52** pt. 1 pp. 31–41, 12 refs. London, 1961.

The following is virtually the authors' summary. The history of the use of pyrethrum formulations to control *Antestiopsis* spp. on *arabica* coffee in

Kenya is reviewed [*cf. R.A.E.*, A **21** 34, 302; **24** 240]. The material with which the present work was done comprised three distinct forms of *Antestiopsis* of doubtful taxonomic status [*cf.* **44** 448]; they were not observed to differ in their response to the insecticidal treatments used. Laboratory experiments showed that *Antestiopsis* was highly susceptible to pyrethrum in emulsion sprays and that the addition of piperonyl butoxide, a pyrethrum synergist, did not increase this response. Preliminary field experiments showed that concentrations of pyrethrins higher than those found effective in the laboratory were required. A hypothesis is advanced and established that this was due to a variable proportion of the insects becoming paralysed and falling off the tree before acquiring a lethal dose.

These observations and experiments suggested a two-phase method of control, using pyrethrum as a non-persistent foliage spray at an economical but effective concentration of 0·005–0·006 per cent. pyrethrins, coupled with a 5 per cent. DDT or 0·5 per cent. dieldrin dust applied to the bole of the tree to form a persistent toxic barrier. The spray removed the bugs from the tree and the dust prevented the return of or killed those that had received a sub-lethal dose of pyrethrum. It seemed unlikely that such a localised application of the persistent insecticide would have any appreciable effect on beneficial insects. This two-phase treatment has been used successfully both in trials and in commercial practice for the control of *Antestiopsis*. When the initial population is in excess of 20 per tree, two applications of the spray and one of the dust are necessary to effect control.

Dadd (R. H.). **Observations on the effects of carotene on the growth and pigmentation of locusts.**—*Bull. ent. Res.* **52** pt. 1 pp. 63–81, 3 figs., 39 refs. London, 1961.

The following is virtually the author's summary. A method of obtaining locust eggs that could be expected to be deficient in carotene is described. It involved rearing a parental generation on an artificial diet, which, because of certain pigmentation abnormalities induced, was probably itself deficient in carotene. When crowded hatchlings of *Locusta migratoria* (L.) from eggs thus modified were used, it was shown that they were sensitive to dietary carotene, whereas hatchlings from normal eggs were indifferent. The absence of carotene was marked by inferior growth, lessened activity and, most notably, an extremely different coloration in both hoppers and adults. Without carotene, melanisation was absent or greatly reduced and in many cases the integument developed a greenish-blue colour. With carotene, heavy melanisation occurred in the hoppers, and the colour of the adults was that characteristic of the gregarious phase. It was concluded that in normal eggs the amount of carotene present is usually sufficient to mask the expression of a dietary deficiency during nymphal growth, but that, with normal eggs having low amounts of carotene, a dietary deficiency might become apparent, as it did with modified eggs.

It is suggested that the blue colour of modified *Locusta* hoppers reared without carotene is due to mesobiliverdin, a prochromogen of insectoverdin, the green pigment of the *solitaria* phase of locusts. Insectoverdin itself could not be formed because it contains carotenoids, and these were absent from the diet. The effect of extreme deprivation of carotene is therefore to induce solitaroid tendencies, notably in regard to colour (suppression of melanin and production of mesobiliverdin) but also in regard to activity. Crowded hoppers of *Schistocerca gregaria* (Forsk.) reared on synthetic diets lacking carotene usually had turquoise-blue blood by the fifth instar. It

was shown, by the electrophoresis of yellow, green and blue bloods in parallel, that the blue chromoprotein of blue blood is the same as the blue chromoprotein of green blood. Its prosthetic pigment must therefore be mesobiliverdin. The abnormalities of coloration that arise in crowded *Locusta* and *Schistocerca* when deprived of carotene are normal in the solitary phase. Moreover, they resemble those abnormalities of coloration consequent upon the implantation of additional corpora allata into gregarious hoppers. The implications of this are discussed in relation to the validity of phase criteria, and an attempt is made to relate these findings to hypotheses on the humoral regulation of phase [*cf. R.A.E.*, A **45** 41].

Harris (K. M.). **The sorghum midge,** *Contarinia sorghicola* **(Coq.), in Nigeria.**—*Bull. ent. Res.* **52** pt. 1 pp. 129–146, 1 pl., 5 figs., 13 refs. London, 1961.

The following is based almost entirely on the author's summary. *Contarinia sorghicola* (Coq.) was discovered in Nigeria in 1953 [*cf. R.A.E.*, A **41** 319], and a subsequent survey indicating its widespread occurrence in the country was followed in 1955–59 by the investigations here described, which were carried out mainly in the Northern Region. The food-plants of the Cecidomyiid in Nigeria are sorghum (guineacorn), which annually provides about two million tons of grain for human consumption, and the wild grasses, *Andropogon gayanus* and *Sorghum arundinaceum* (wild sorghum). In Northern Nigeria, midges emerge from infested sorghum heads in the early morning, and, after mating, the females oviposit within the spikelets of recently flowered heads, laying twice as many eggs on the glumes as on the pales. Each female may lay about 50 eggs, and both males and females usually die within ten hours of emergence. The eggs hatch in four days, and, after feeding for ten days, during which the ovary shrivels up, the larvae pupate within the spikelet. The cycle from egg to adult is completed in 19–22 days during the growing season, but towards the end of the rains the larvae spin cocoons and enter diapause. Large numbers of diapause larvae are carried through the dry season in late-flowering heads; because of severe infestation, these are not harvested, but remain on the stems, which are stacked and used for building and fencing or as fuel. Smaller numbers of larvae are present in threshing trash. In cages, the first adults from the diapause population emerged half-way through the rains, about 5–7 weeks after the weekly mean relative humidity had exceeded 60 per cent., and emergence continued for 9–12 weeks. Field observations confirmed experimental observations and showed that the build-up of the midge population before the main crop comes into flower is largely dependent on the presence of early-flowering varieties. So long as sufficient sorghum is in flower and the weather is favourable, the midge population increases steadily to a peak in October and early November.

A. gayanus appears to be of little importance as an alternative food-plant, and preliminary evidence of the existence of a distinct biological race of *C. sorghicola* developing on it is presented. *S. arundinaceum* may be important in the south, where it is most abundant, but it is uncommon and of little importance in the main sorghum-growing areas of the north. *Eupelmus* sp., *E. popa* Gir., *Aprostocetus* sp. and two species of *Tetrastichus* parasitise *C. sorghicola*, and examples of the three genera are generally present at Samaru (Northern Region) in the ratio of 3 : 1 : 1. They are only of importance late in the season. Two spiders, *Thomisus* sp. and one tentatively referred to the genus *Diaea*, prey on ovipositing females, but are apparently of little importance.

Experiments showed a significant negative linear regression of yield on the proportion of spikelets attacked. There is no evidence of compensation, and estimation of the proportion of spikelets attacked gives a direct measure of the loss of yield. In 1957 and 1958, the proportion of spikelets containing larvae and pupae in random samples of spikelets taken from crops throughout Northern Nigeria was estimated by dissecting 50-spikelet sub-samples taken at random from each sample, and the maturity of the sample was measured in each sub-sample by counting the number of spikelets that had not flowered. Many samples were immature and were discarded, but in 52 mature sub-samples obtained in 1957, 10·5 per cent. of all the spikelets were infested, and in 167 obtained in 1958, 4·1 per cent. were infested. In 1957, the results did not permit estimation of over-all crop losses, but in 1958 it was estimated that at least 91,000 tons of grain, valued at £1,822,000 and representing the produce of 218,200 acres, were lost because of infestation by *C. sorghicola*.

The pattern of intensity of attack in the survey samples suggests that in the main sorghum-growing areas, which lie above 9°N. lat. at an altitude exceeding 1,000 ft., damage is less severe than in lower latitudes and at lower altitudes, where heavier attacks probably result from the longer growing seasons, higher humidities and greater abundance of *S. arundinaceum*.

Nigerian farmers recognise the empty heads caused by *C. sorghicola*, but are unaware of the midge itself, and, until they have learned to recognise cause and effect, control measures depending on their co-operation may be unsuccessful. Cultural control by disposal of crop residues and the growing of a uniformly flowering crop would be the most natural and effective method in the main sorghum-growing areas. There is little possibility of achieving chemical control at present and, though the field resistance of the Nunaba group of varieties from Ghana was confirmed in Nigeria, laboratory experiments suggest that when the midge is not free to choose between resistant and non-resistant varieties it can adapt its behaviour and will then oviposit on resistant varieties.

Griffiths (D. C.). **The development of *Monoctonus paludum* Marshall (Hym., Braconidae) in *Nasonovia ribis-nigri* on lettuce, and immunity reactions in other lettuce aphids.**—*Bull. ent. Res.* **52** pt. 1 pp. 147–163, 32 figs., 16 refs. London, 1961.

The following is based almost entirely on the author's summary. *Monoctonus paludum* Marshall parasitises *Myzus* (*Nasonovia*) *ribis-nigri* (Mosley) on lettuce in Britain [*cf. R.A.E.*, A **48** 429] and oviposits, but is unable to complete its development, in *M.* (*Aulacorthum*) *circumflexus* (Buckt.), *M. persicae* (Sulz.), *Macrosiphum euphorbiae* (Thos.) and *M.* (*A.*) *solani* (Kalt.) [*cf.* **48** 430], which also infest this crop. Aphids of all five species were exposed to attack by the Braconid and sectioned and dissected after various intervals so that its developmental processes might be observed. The egg was always laid in the posterior mass of fused ventral nerve ganglia in the thorax of the host, and normal development in *Myzus ribis-nigri* is described. In *M. circumflexus*, parasite development was arrested after about 24 hours by the secretion round it of a thin brown capsule formed by the blood-cells of the host. In the other three aphids, no capsule formation occurred and the development of the parasite embryos was rather variable, but it was common for parasites in *Macrosiphum euphorbiae* to reach the stage normal for 24-hour embryos and for those in *M. solani* and *Myzus persicae* to reach rather less advanced stages before degenerative changes set in. The degenerative changes in the embryos in aphids of each species are described, and their nature is discussed.

Joyce (R. J. V.). **Some factors affecting numbers of *Empoasca lybica* (de Berg.) (Homoptera: Cicadellidae) infesting cotton in the Sudan Gezira.**—*Bull. ent. Res.* **52** pt. 1 pp. 191–232, 7 graphs, 33 refs. London, 1961.

The following is based on the author's summary. *Empoasca lybica* (de Berg.) is an important pest in the Sudan Gezira, where over 300,000 acres of cotton are grown annually under irrigation. The crop is sown in mid-August, and the plants are uprooted and burnt in the following May. The life-cycle of *E. lybica* from egg to gravid adult lasts 16–24 days, and the adults live for up to 40 days. There is no diapause. During the 100 days from late August to early December when breeding on cotton is of economic importance, a single pair could give rise to some 50,000 progeny. During May–July, when crops are confined to irrigated gardens and river banks, *E. lybica* is widely distributed in such places and can be found also on trees, which are numerous, especially in the southern Gezira and along river banks. There is circumstantial evidence of displacement over long distances, and the great majority of catches on sticky traps were made before the increase in population on cotton that occurs from September onwards. Of over 50 species of food-plants recorded, only *Solanum dubium*, *Rhynchosia memnonia*, *Hibiscus* spp. and *Abutilon* spp. are of importance in the ecology of *E. lybica*. The first two especially are common weeds in fallows, which comprise more than half the land under rotation. Populations of *E. lybica* in the fallows at the time of cotton germination tended to be greatest where pre-sowing rains (falling between 1st July and 15th August) were highest. Correspondingly, initial infestation of cotton was highest in seasons and places receiving the most pre-sowing rain, although density of infestation in any place was affected by sowing date and proximity to irrigated fields and gardens supporting weed food-plants.

An examination of the distribution of nymphs on cotton plants made during the development of a sampling method for infestations in the crop showed that they were most numerous in the leafiest zones of the plant, and a random choice of leaves seemed an appropriate means of sampling for infestation. The distribution of nymphs within and between cotton fields was also investigated, and a standard sampling procedure adopted. Peak infestations on cotton could not be predicted from the level of initial colonisation or from surveys a month later, and their size was usually inversely related to the level of initial colonisation, especially when comparisons were made between seasons. The relation of these findings to those of other authors [*R.A.E.*, A **38** 476, 477] is discussed; the hypothesis that pre-sowing mud-splash is a major factor controlling numbers of *E. lybica* [*cf.* **38** 477] is discounted, although it is accepted that this factor temporarily reduces populations. The rate of increase of infestations of *E. lybica* was found to be positively correlated with the concentration of nitrogen recorded 2–4 weeks previously in the cotton leaf. This concentration affected not only the rate of increase of the initial colonisers, but also the rate of recovery of populations during November and December after spray applications of DDT [*cf.* **48** 53]. The nitrogen concentration in the leaf was increased by nitrogenous fertiliser, with a corresponding increase in infestations of *E. lybica*. It was also found to be negatively correlated with pre-sowing rains, which, if low, prevent the nitrate in the top 12 in. of Gezira soil from being washed to lower levels, but the data presented provide no evidence that the relationship is causal. It is concluded that localities and seasons of poor pre-sowing rains favour a high rate of increase of small populations of *E. lybica* because of the high nitrogen concentration in cotton leaves during September and October. This tendency is augmented by the application of nitrogenous fertiliser. A regression

equation relating peak infestations with pre-sowing rainfall and with nitrogenous fertiliser is given, and the infestations computed from this are shown not to differ significantly from those recorded in the Gezira as a whole, and in the four main divisions of it separately, during 1949–56.

Ossowski (L. L. J.). **The biological control of the wattle bagworm, *Kotochalia junodi* (Heyl.), by a virus disease. II. Large-scale experiments.**—*Ann. appl. Biol.* **48** no. 2 pp. 299–313, 8 refs. London, 1960.

The following is substantially the author's summary of this second paper in a series on the control of *Kotochalia junodi* (Heyl.) on wattle [*Acacia mollissima*] in South Africa by means of a polyhedral virus disease [*cf. R.A.E.*, A **45** 385]. To obtain further information on the effect of the virus on *K. junodi* and on the course of an infestation cycle, suspensions of various concentrations and different origins were tested in 1957 against both young and old larvae. Virus of suspected low virulence and suspensions with and without adjuvants were also compared. With infestations in the prodromal stage and the larvae in their first instar at the time of treatment, mortality was similar with suspensions containing 1,000 or 500 polyhedra per cu. mm. Mortality from a concentration of 250 polyhedra per cu. mm. was lower, but still high enough to keep the crowns of the infested trees green. With the higher concentrations, the course of the cycle was greatly accelerated and the eruptive stage and the crisis occurred later in the same season, whereas, with the lowest concentration, the infestation decreased gradually after spraying. Against older larvae, the initial mortality was too low to prevent defoliation, but it had increased sufficiently nine months after spraying to reduce the infestation to its latent stage. Where virus was applied during the eruptive stage, there was a very high initial mortality, and defoliation of trees was light, whereas untreated trees were completely defoliated. Nine months after spraying, however, mortality was equally high in treated and untreated plantations. Viruses from different sources differed considerably in the mortality they caused. Virus introduced from a distant source was more effective than were local strains [*cf.* **49** 122], and at the prodromal stage was more successful in preventing defoliation and loss of yield. Methyl cellulose used as an adhesive did not affect mortality, but skim-milk powder decreased it. Artificially disseminated virus can not only cause epizootics in the treated plantations, but can also spread to neighbouring blocks in the years following treatment.

Dunn (J. A.). **The use of endrin and other insecticides against lettuce root aphid, *Pemphigus bursarius* L.**—*Ann. appl. Biol.* **48** no. 2 pp. 314–322, 3 refs. London, 1960.

The following is based largely on the author's summary. The value of γ BHC (lindane), schradan, aldrin and endrin applied as dressings to lettuce seed in protecting the plants against *Pemphigus bursarius* (L.) was tested in field experiments in central England in 1955. Endrin was the only one to give promising results, and a 50 per cent. dust, with an adhesive, mixed with an equal weight of seed reduced aphid numbers by 86 per cent. Germination was not impaired if the seed was used immediately after treatment. In 1957, the dressing with endrin gave good control and was superior to one of 44 per cent. phorate (Thimet) mixed with ten times its weight of seed, which was also effective, but in 1956 and 1958 it failed to control the aphid. When an endrin seed dressing was supplemented by a spray of 0·2 per cent. endrin

applied to the seedlings at 8 fl. oz. per 40 ft. of row before singling, consistently good control resulted. A high level of control was obtained in 1958 with two sprays of 0·1 per cent. diazinon applied along the rows at 8 fl. oz. per 40 ft. after singling and at the early rosette stage. A dust or spray of endrin and a spray of diazinon applied to the soil before sowing at 4 lb. actual insecticide per acre and incorporated to a depth of 3 in. also gave good control. Endrin cannot be recommended for use on lettuce until the amounts and persistence of the residues are known.

MacCuaig (R. D.). **The toxicity of some insecticides to fifth-instar nymphs of the desert locust.**—*Ann. appl. Biol.* **48** no. 2 pp. 323–335, 3 figs., 22 refs. London, 1960.

In the experiments described, insecticides dissolved in or diluted with KEB (kerosene extract bottoms) [*cf. R.A.E.*, A **47** 159] were applied topically to fifth-instar hoppers of *Schistocerca gregaria* (Forsk.), and mortality was calculated after 24 hours or more. The LD50's and LD99's, in μg. per g. body weight, were 1·9 and 3·6 for parathion, 1·9 and 4·6 for dieldrin, 5·7 and 14·3 for heptachlor, 8·7 and 19·5 for γ BHC and 12·7 and 33·7 for diazinon. The toxicity of DNC decreased considerably with the age of the hoppers and the LD50 ranged from 12·5 to 43 and the LD99 from 20 to 90 μg. per g. body weight. Hoppers were most resistant to γ BHC 2·5 and 4·5 days after moulting and showed a slight decrease in resistance to diazinon 8·5 days after moulting. No significant change in toxicity was found when the insecticides were injected into the body cavity of the hoppers. Attempts to determine the influence on susceptibility of sex, body weight and starvation before and after dosing gave generally inconclusive results.

Hussey (N. W.), Wyatt (I. J.) & Hughes (J. T.). **Insecticidal control of paedogenetic Cecid larvae in mushroom beds. I. Incorporation of insecticides into compost.**—*Ann. appl. Biol.* **48** no. 2 pp. 336–346, 3 graphs, 10 refs. London, 1960.

Hussey (N. W.) & Wyatt (I. J.). **II. Incorporation of insecticides in the casing layer.**—*T. c.* pp. 347–351, 1 graph, 2 refs.

The following is based partly on the authors' summary of the first part of this paper. In experiments in southern England, an emulsion spray of γ BHC applied to mushroom compost at 50 parts toxicant per million and mixed thoroughly with it during the last turn of composting delayed the reproduction of paedogenetic larvae of *Heteropeza pygmaea* Winn. and *Mycophila speyeri* (Barnes) [*cf. R.A.E.*, A **47** 269] without reducing the yield of mushrooms. The other six insecticides tested were less satisfactory as they did not control the larvae, were not sufficiently persistent or decreased the yield, but aldrin and dieldrin were superior to dimethoate (Rogor), malathion, trichlophon (Dipterex) and dimetan, which was the least effective. In general, insecticides appeared to be more effective against *Mycophila* than against *Heteropeza*. Large Cecidomyiid populations did not depress yields on normal composts, but a proportion of the larvae migrated to the fructifications, thus reducing the value of the crop.

The second part comprises an account of experiments to investigate the possibility of preventing the larvae from migrating to the fructifications by incorporating an insecticide throughout the casing before applying it to the beds. The larvae of *M. speyeri* and *M. barnesi* Edw., which are orange, are conspicuous and difficult to remove, and their presence on the mushrooms

renders them unmarketable; those of *H. pygmaea*, which are white, induce bacterial decomposition of the gills and cap. These species reach peak populations in the order given, and preliminary studies indicated that the larvae move freely towards the surface of the compost bed only when adequate water films are present [*cf. loc. cit.*], as after watering. Emulsion sprays of γ BHC and aldrin, both at 10 p.p.m., applied to the casing immediately before its application to beds artificially infested with larvae of *M. speyeri* almost completely prevented migration to the fructifications and caused no significant decrease in yield, but malathion and pyrethrins with piperonyl butoxide were of no practical value. Since spent compost is frequently used on horticultural land and, if treated with BHC, might taint some root crops, aldrin appears to be the most promising material. The insecticides are best applied as emulsions in as small a volume of water as will ensure even distribution.

Wyatt (I. J.). **Cecidomyiidae as pests of cultivated mushrooms.**—*Ann. appl. Biol.* **48** no. 2 pp. 430–432, 3 refs. London, 1960.

This brief account of the Cecidomyiids that attack cultivated mushrooms in Britain includes information on the species concerned, their bionomics, seasonal development, effect on the crop and on yield, and control, most of which has already been noticed from other sources [*cf. R.A.E.*, A **47** 269; **48** 445; and preceding abstract].

Howe (R. W.). **The effects of temperature and humidity on the rate of development and the mortality of** *Tribolium confusum* **Duval (Coleoptera, Tenebrionidae).**—*Ann. appl. Biol.* **48** no. 2 pp. 363–376, 7 graphs, 41 refs. London, 1960.

The following is virtually the author's summary. The speed of development and the developmental mortality of *Tribolium confusum* Duv. were studied over a series of constant temperatures between 15 and 40°C. [59 and 104°F.] at 10, 30, 70 and 90 per cent. relative humidity, using wheat-feed as food. Eggs did not hatch at 15 or 40°C. at any humidity. At 37·5°C. [99·5°F.], about 60 per cent. of the eggs hatched, and at all other conditions about 90 per cent. hatched. The effect of temperature on the duration of the egg period is shown graphically, the shortest period being at 35°C. [95°F.]. Humidity did not affect the egg period. Larvae failed to develop to pupae at 17·5°C. [63·5°F.], at 10 per cent. relative humidity at 20°C. [68°F.], and at 10 and 90 per cent. relative humidity at 37·5°C. The rate of larval development was affected by both temperature and humidity, being quickest at the higher humidities and at about 32·5°C. [90·5°F.]. Larval mortality was less than 16 per cent. except at 37·5°C. at 10 per cent. relative humidity or less, and at 20°C. at 90 per cent. relative humidity. The duration of the pupal period was not affected by humidity and was shortest at 37·5°C. The total developmental period is compared with that of *T. castaneum* (Hbst.) [*cf. R.A.E.*, A **44** 411] over the range of temperature and humidity conditions in which both species can grow. The optimum for developmental speed and the maximum and the minimum temperatures at which development is possible were all about 2·5°C. [4·5°F.] lower for *T. confusum* than for *T. castaneum*. The developmental periods for the two species were equal at temperatures between 23 and 27°C. [73·4 and 80·6°F.], depending on humidity. At lower temperatures, *T. confusum* developed the more quickly and at higher temperatures the more slowly.

Broadbent (L.). **Infectivity of aphids bred on virus-infected cauliflower plants.**—*Ann. appl. Biol.* **48** no. 2 pp. 377–383, 29 refs. London, 1960.

The following is virtually the author's summary. Caged cauliflower plants infected with either cabbage black ring spot virus (CBRSV) or cauliflower mosaic virus (ClMV) were infested with *Myzus persicae* (Sulz.) or *Brevicoryne brassicae* (L.). Winged and wingless aphids that voluntarily flew or crawled from these plants were transferred singly to healthy seedlings of cauliflower or, occasionally, other crucifers to compare their feeding behaviour and ability to transmit the viruses. Wingless aphids settled to probe more readily than winged ones, and *B. brassicae* was initially more restless than *M. persicae*. ClMV was more readily transmitted than CBRSV by both species, and *B. brassicae* rarely transmitted CBRSV. Wingless aphids transmitted less often than winged ones, and no wingless examples of *B. brassicae* transmitted CBRSV, although they did ClMV. Fewer aphids transmitted CBRSV from old plants than from young ones, but plant age had little effect on ClMV transmission.

Baker (P. F.). **Aphid behaviour on healthy and on yellows-virus-infected sugar beet.**—*Ann. appl. Biol.* **48** no. 2 pp. 384–391, 1 graph, 4 refs. London, 1960.

The following is largely the author's summary. *Myzus persicae* (Sulz.), *M. ascalonicus* Doncaster, *Aphis fabae* Scop. and *Macrosiphum* (*Aulacorthum*) *solani* (Kalt.), when caged on sugar-beet leaves in the glasshouse, preferred leaves infected with yellows virus to healthy ones; they chose those with the most severe symptoms, on which they bred more rapidly and lived longer than on green leaves. *Myzus persicae* behaved similarly on whole plants in the glasshouse. Among aphids reared for over a week on turnip or on healthy or infected sugar-beet and subsequently offered leaves from both healthy and infected sugar-beet, those reared on infected leaves showed the greatest and those on healthy sugar-beet the least preference for the infected leaves. Differences between the multiplication rates of aphids on healthy plants of inbred sugar-beet varieties were eliminated or reversed by infection with yellows virus. Spraying healthy plants with either sugar solutions or hydrolysate of casein increased the multiplication rate of *M. persicae*, but much less than did virus infection.

Wheatley (G. A.) & Hardman (J. A.). **The bioassay of residues of insecticides in soil.**—*Ann. appl. Biol.* **48** no. 2 pp. 423–427, 19 refs. London, 1960.

A method for the bioassay of insecticide residues left in the soil after treatment of the latter against agricultural pests was devised in connection with work on the control of the carrot fly, *Psila rosae* (F.), in Britain. A technique capable of detecting residues of dieldrin at concentrations of 0·05–5 parts per million in soil was required, and a modification of one by Lichtenstein & Schultz [*cf. R.A.E.*, A **47** 268] was adopted. It consists in applying aliquots of an extract prepared as the supernatant liquid obtained after tumbling a soil sample end-over-end for an hour with a known volume of acetone in a sealed bottle to cotton dental rolls, on which adults of *Drosophila melanogaster* Mg. are exposed after the solvent has evaporated. The range of doses that could be assayed directly for any fixed exposure time

was limited, but most of the range of dieldrin residues likely to be met with in practice (0·03–5 p.p.m.) could be covered by estimating the time required for response from 50 per cent. of the test insects and relating it to the dose. To overcome practical difficulties in recording, an automatic recording apparatus was devised.

The method was used to determine the effect of soil cultivation on the depth distribution of dieldrin in a sandy loam in central England. In a plot in which dieldrin was applied superficially at 12 oz. per acre and the soil was cultivated to a depth of about 4 in. by double rotary cultivation, no insecticide was found below a depth of about $2\frac{3}{4}$ in. five months later, but in another plot that had been treated over $3\frac{1}{2}$ years earlier at 2 lb. per acre, had received two initial rotary cultivations and had subsequently been ploughed to a depth of about 8 in. on three occasions, dieldrin was present to a depth of about $8\frac{1}{2}$–$9\frac{1}{2}$ in. Bioassay of samples from plots treated with dieldrin at 1, 2 and 3 lb. per acre over $3\frac{1}{2}$ years earlier indicated that the half-life of this material in the sandy loam tested is about four years; some evidence was obtained that the rate of loss may vary with the amount of insecticide present [*cf.* **48** 225]. D. W. Wright found that dieldrin applied to a fen soil in March 1956 at 2 and 4 lb. per acre still reduced populations of *P. rosae* by 80 and 98 per cent., respectively, in 1959; the rates of loss of aldrin and γ BHC (lindane) were greater, but their residues were apparently more toxic in 1959 than in 1958.

Dicker (G. H. L.). **A field study of the spread of apterous forms of the strawberry aphid,** *Pentatrichopus fragaefolii* **(Cock.).**—*47th Rep. E. Malling Res. Sta. 1958–59* pp. 105–108, 2 figs., 3 refs. East Malling, 1960.

Although immigrant winged forms of *Capitophorus* (*Pentatrichopus*) *fragaefolii* (Ckll.) undoubtedly introduce viruses into young strawberry beds in southern England [*cf. R.A.E.*, A **41** 40], it seems likely that immature and apterous forms, which are present on the plants throughout the year, are responsible for spread within a plot. Their movements were therefore studied under field conditions on first-year plants in 1955 and 1956. After artificial infestation of narrow plots with apterae in July, the aphids spread along the rows from a central point for about 15 ft. by November, but moved very little further between November and April. It is suggested that much of the spread occurred because the aphids left maturing leaves as these became less palatable.

Muir (R. C.) & Gambrill (R. G.). **A note on the knock-down method for estimating numbers of insect predators on fruit trees.**—*47th Rep. E. Malling Res. Sta. 1958–59* pp. 109–111, 2 pls., 2 refs. East Malling, 1960.

The authors describe a method of estimating the numbers of adults of *Blepharidopterus angulatus* (Fall.) on fruit trees by enclosing the tree in a sheet, applying an extract of pyrethrins in an aerosol and counting the insects that fall on groundsheets [*cf. R.A.E.*, A **41** 168]. In a test of its accuracy, known numbers of marked adults were liberated before treatment; 48–77 per cent. were recovered after it, and it was thus possible to estimate the number present at the time of knockdown from the numbers of unmarked insects collected.

Couturier (A.) & Robert (P.). **Recherches sur les migrations du hanneton commun** (*Melolontha melolontha* **L.**).—*Ann. Épiphyt.* **9** no. 3 pp. 257–328, 32 figs., 31 refs. Paris, 1958. (With summaries in English & German.)

The authors describe numerous further experiments, carried out in eastern France in 1955–57, on the orientation of the adults of *Melolontha melolontha* (L.) in their flights to woods for feeding and back to fields for oviposition [*cf. R.A.E.*, A **46** 206, etc.]. In general, the results confirmed those already obtained, and showed that the direction of evening flight during the primary movement to the woods for feeding, the return flight in the reverse direction for oviposition and renewed flight in the original direction to the woods for further feeding was little affected by capture of females during the flight and subsequent release in the same or another place. The results were a little less certain when females taken during the primary flight in the evening were released in the morning. The direction of the primary flight was determined as a result of orienting movements carried out when the newly emerged beetles first left the soil. The direction of flight was little affected by smoke screens (except in the case of primary flights), artificial changes in the period of light, exposure to cold or a period of anaesthesia (narcosis), but was modified in the morning when the apparent position of the sun was altered by means of reflectors or when the sky was not visible or not clear. No flight took place in the afternoon, and beetles released then appeared unable to orient themselves in the normal way.

Guennelon (G.) & Féron (M.). **La receptivité des pêches aux attaques de** *Ceratitis capitata* **Wied. dans la vallée du Rhône.**—*Ann. Épiphyt.* **9** no. 3 pp. 355–370, 4 figs., 4 refs. Paris, 1958.

The following is based on the authors' summary and conclusions. Experiments showed that peaches of varieties grown in southern France become ripe enough for eggs of *Ceratitis capitata* (Wied.) to be laid in them 6–8 weeks before the beginning of harvest, but no infestation develops as early as this, because of a gumming reaction of the fruits. Complete development of larvae is possible 4–5 weeks before harvest for varieties having white flesh and 3–4 weeks before it for those with yellow flesh (late varieties). If eggs are laid and the peaches are then detached from the tree, larval development can occur earlier, because the fruit reaction does not occur. Fallen fruits are thus a source of danger in an orchard, long before ripening is completed. The rapidity of development of the eggs and larvae increases as the fruits reach maturity, owing to an increase in the nutritive properties of the fruits and also to the higher prevailing temperatures. In the lower Rhône valley, a generation is completed in a month, but infestation is continuous, owing to overlapping and the successive ripening of peaches of different varieties.

Anglade (P.). **Influence de l'enfouissement des tiges de maïs sur l'hivernation et la survie des chenilles endophytes** (*Pyrausta nubilalis* **Hubn. et** *Sesamia nonagrioides* **Lef.**).—*Ann. Épiphyt.* **9** no. 3 pp. 371–385, 6 figs., 9 refs. Paris, 1958.

Burial of maize stalks has long been recommended in the United States as a means of controlling the hibernating larvae of *Ostrinia* (*Pyrausta*)

nubilalis (Hb.), and, in this paper, details are given of investigations in France showing that it is effective against both *O. nubilalis* and *Sesamia nonagrioides* (Lef.), which is very susceptible to cold.

Orphanidis (P. S.), Karayannis (G. B.), Alexopoulou (P. S.), Tsakmakis (A. A.) & Daniélidou (R. K.). **Expériences concernant l'efficacité de certains insecticides phosphorés sur le *Dacus* de l'olive effectuées en 1957.**—*Ann. Inst. phytopath. Benaki* (N.S.) **1** no. 5 pp. 229–289, 16 figs., 25 refs. Athens, 1958.

Orphanidis (P. S.) & Adam (N. H.). **Résidus de Rogor, Ekatin, Dipterex, Ciba et Nexion dans l'huile et dans les jus d'olive.**—*T.c.* pp. 314–319, 1 ref.

The following is based on the authors' summary of the first paper, which comprises a detailed account of further experiments on the control of *Dacus oleae* (Gmel.) on olive on the Greek island of Euboea in 1957 [*cf.* *R.A.E.*, A **48** 493]. Six organophosphorus insecticides were tested in sprays, and consideration of the percentages of fruits punctured and infested and of the larvae found living or dead in the olives showed that dimethoate (Rogor) at 0·03 or 0·06 per cent. gave the best results at all sampling dates between September and December, with no difference between the two concentrations of between an emulsion concentrate and a wettable powder. Efficacity, measured as the corrected reduction in cases of advanced infestation (third-instar larvae, pupae or emergence holes), was about 97·8 per cent. 45 days after the final application. Mortality of larvae and pupae in the olives was 87·3 per cent. 21 days after the last application, and still fairly high (52·4 per cent.) 31 days after it. Dimethoate was also tested as a 3 per cent. dust on small trees, and gave equally good results. Attempts to obtain control throughout the season with a single application of spray or dust made in August proved unsuccessful. Of the other materials tested, all in sprays prepared from emulsion concentrates, the best were thiometon (Ekatin), parathion and trichlorphon (Dipterex).

It is stated in the second paper that the residues of dimethoate, thiometon and trichlorphon found in oil from the treated olives did not exceed 0·5 part per million and that residues of thiometon and trichlorphon in the juice from pressed olives were below 0·2 p.p.m., despite the high solubility of these materials, particularly the second, in water.

Orphanidis (P. S.), Karayannis (G. B.) & Adam (N. H.). **Recherches expérimentales sur la décomposition des résidus de parathion et de Rogor par immersion des olives dans des solutions de sels et de substances alcalines.**—*Ann. Inst. phytopath. Benaki* (N.S.) **1** no. 5 pp. 290–299, 1 ref. Athens, 1958.

Numerous chemicals were tested in Greece for their ability to decompose residues of dimethoate (Rogor) and parathion in olives sprayed with these materials for the control of *Dacus oleae* (Gmel.) [*cf.* preceding abstract]. Considerable decomposition was brought about by immersion in solutions of sodium hydroxide and to a less extent potassium hydroxide, but triethanolamine, which is also alkaline in reaction, an enzyme preparation and various metallic salts were ineffective.

Orphanidis (P. S.) & Tsakmakis (A. A.). **Recherches expérimentales sur la phytotoxicité du malathion sur l'olive.**—*Ann. Inst. phytopath. Benaki* (N.S.) **1** no. 5 pp. 300–305, 1 graph, 6 refs. Athens, 1958.

Details are given of experiments showing that malathion is injurious to olive trees sprayed with it during periods of high temperature in Greece. Wettable-powder sprays were less harmful than emulsions.

Orphanidis (P. S.), Alexopoulou (P. S.), Tsakmakis (A. A.) & Karayannis (G. B.). **Recherches expérimentales concernant l'action systémique exercée sur le *Dacus* par certains insecticides phosphorés à base de phosphamidon et de thiométon.**—*Ann. Inst. phytopath. Benaki* (N.S.) **1** no. 5 pp. 306–313, 1 ref. Athens, 1958.

An account is given of experiments in Greece showing that phosphamidon and thiometon had no systemic action against larvae of *Dacus oleae* (Gmel.) in olives when emulsion sprays were applied to the lower branches of the trees or to the soil near the roots in October, and little evidence of translocation could be detected in laboratory tests.

Nigam (L. N.) & Venkatesh (M. V.). **A campaign against San José scale in Himachal Pradesh.**—*Plant Prot. Bull.* **8** (1956) no. 1 pp. 5–7. New Delhi [1959].

Details are given of a local campaign against the San José scale [*Quadraspidiotus perniciosus* (Comst.)] on apple in an area in the lower Himalayan region of India in 1954. Sprays of diesel-oil emulsion with soap were prepared (oil content about 3·84 per cent. or less) and applied thoroughly to all parts of the trees, and mortality ranging up to 94·3 per cent. was obtained after two weeks.

Nagarajan (K. R.) & Edwards (J. J. D.). **Control of the cholam earhead bug with BHC in Coimbatore.**—*Plant Prot. Bull.* **8** (1956) no. 1 pp. 12–13. New Delhi [1959].

Calocoris angustatus Leth. is the most important of the insects that attack sorghum (cholam) in Coimbatore. Development is completed in 13–17 days, and both nymphs and adults suck the sap from the tender parts of the heads, preventing grain formation. A dust of 5–10 per cent. BHC gives good control.

Nagaraja Rao (K. R.) & Abraham (E. V.). **The gram caterpillar, a serious pest of jowar in Madras State.**—*Plant Prot. Bull.* **8** (1956) no. 2 pp. 19–20, 2 refs. New Delhi [1959].

Heliothis armigera (Hb.) (*obsoleta*, auct.) caused serious damage to sorghum (jowar) in Madras State in 1953. In tests on control, DDT in a 10 per cent. dust or a 0·2 per cent. spray applied at high rates, gave the best results, affording complete control in 48 hours.

Nigam (L. N.) & Venkatesh (M. V.). **Trials of some synthetic insecticides against San José scale.**—*Plant Prot. Bull.* **9** (1957) no. 1 pp. 14–20, 2 refs. New Delhi, 1959.

In a field test in northern India, various organic insecticides were tested in emulsion sprays for the control of the San José scale [*Quadraspidiotus perniciosus* (Comst.)] on apple. The results showed that all materials gave highly significant control and that diazinon, DNC (as the sodium salt), and diesel oil were more effective than malathion or parathion, diazinon being the best.

Nigam (L. N.). **Outbreaks of the spotted grasshopper in Assam and West Bengal.**—*Plant Prot. Bull.* **9** (1957) no. 2 pp. 13–15, 1 ref. New Delhi, 1959.

Bands of hoppers of *Aularches miliaris* (L.) were observed in many parts of Assam and West Bengal in 1951, and damage to many crops occurred. No swarms of adults developed. The life-cycle of this grasshopper, which has one generation a year, is described from the literature [*R.A.E.*, A **14** 234]. The usual measures afforded control.

Sakurai (K.) & Horita (Y.). **Studies on the bionomics of** *Onychiurus folsomi* **Schäffer.** [*In Japanese.*]—*Res. Bull. Hokkaido nat. agric. Exp. Sta.* no. 74 pp. 73–79, 5 figs., 13 refs. Kotoni, Sapporo, 1959. (With a summary in English.)

Onychiurus folsomi (Schaeffer) injured rice seedlings in seedbeds covered with oil-paper in Hokkaido in the spring of 1955. Observations on its bionomics showed that it has some 3–4 generations a year, winter being passed in the larval or adult stage in the soil or under decayed leaves or débris. The eggs are laid in masses of 15–20 in the ground, and hatch in about 15 days in saturated soil at about 17–20°C. [62·6–68°F.]. The optimum temperature for the later stages is about 15°C. [59°F.].

Takeuchi (S.). **Comparative studies on the corn borer attacking corn and bean.** [*In Japanese.*]—*Res. Bull. Hokkaido nat. agric. Exp. Sta.* no. 74 pp. 80–86, 7 figs., 7 refs. Kotoni, Sapporo, 1959. (With a summary in English.)

Morphological differences were noted in Japan in 1953 between adults of *Ostrinia* (*Pyrausta*) *nubilalis* (Hb.) from maize and beans, including a thickened tibia of the mid-leg of the male from beans. In captivity, development of both types was completed on each plant, but the normal moths preferred maize and the abnormal ones beans for oviposition.

Kiyoku (M.) & Tamaki (H.). **Modification in biotic potential of insects surviving exposure to an insecticide.** [*In Japanese.*]—*Sci. Rep. Fac. Agric. Okayama Univ.* no. 14 pp. 1–5, 9 refs. Okayama, 1959. (With a summary in English.)

The following is substantially the authors' summary. Experiments were conducted to determine the effect of a single endrin treatment upon the

oviposition, sex ratio, survival rate during the growing period from egg to pupa, and body weight of a parent generation of *Callosobruchus chinensis* (L.) and the subsequent three filial generations. Adults that survived endrin-treatment produced 22 per cent. fewer eggs than the controls, whereas the egg production of untreated females mated with treated males represented a 32 per cent. increase. In the untreated adults of the F_1 generation descended from the treated parents, the number of eggs deposited represented a 25 per cent. increase. Body weight was significantly greater, and the sex ratio was less than 0·45. However, there was no significant difference in survival rate during the growing period. The phenomena described were reversed in the next two generations.

Koizumi (K.) & Kiyoku (M.). **Studies on the biology and control of cutworms. I. Cutworm faunal compositions in the tobacco field at the planting season in Okayama Prefecture.** [*In Japanese.*]—*Sci. Rep. Fac. Agric. Okayama Univ.* no. 14 pp. 7–18, 1 map, 24 refs. Okayama, 1959. (With a summary in English.)

The following is based on the authors' summary. A survey in tobacco fields in Okayama Prefecture showed the presence of three species of cutworms, *Agrotis segetum* (Schiff.) (*fucosa* Btlr.), *A. tokionis* Btlr. and *A. ypsilon* (Hfn.), which occurred in the proportions 71:19·9:9·1. Their local distribution is discussed.

Beardsley (J. W.). **On the taxonomy of pineapple mealybugs in Hawaii, with a description of a previously unnamed species (Homoptera: Pseudococcidae).**—*Proc. Hawaii. ent. Soc.* **17** no. 1 pp. 29–37, 2 figs., 11 refs. Honolulu, 1959.

Two species have been confused under the name *Dysmicoccus brevipes* (Ckll.) in Hawaii, one considered to be the true *D. brevipes*, which is here recorded from the stems and roots of several grasses, including sugar-cane, from pineapple butts, and from the roots of *Melilotus indica*, and one described from the adult females as *D. neobrevipes*, sp.n., which was found on pineapple and a number of other plants. Characters differentiating them are discussed. *D. neobrevipes* is apparently ovoviviparous, and winged males developed in all the colonies studied. Males were never found in colonies of *D. brevipes*. Both are polyphagous, but *D. neobrevipes* infests the aerial parts of its food-plants, whereas *D. brevipes* usually occurs near the base. *D. neobrevipes* has not been found on grasses; it probably represents the bisexual strain of *D. brevipes* mentioned by Ito [*R.A.E.*, A **26** 570–571].

Martin (Henri). **Mission en Libye. Observations phytosanitaires et protection des plantes en Cyrenaïque.**—[2+] 63 pp., 5 graphs, 4 maps, multigraph. **Observations phytosanitaires et protection des plantes au Fezzan.**—22 pp., 1 map, multigraph. **Observations phytosanitaires et protection des plantes en Tripolitaine. I. Répartition géographique et importance des ravageurs et maladies.**—[1+] 23 pp., 4 maps, multigraph. [Tripoli] Org. Nations-Unies Aliment. Agric. [1959].

These three documents consist essentially of lists of the insect and other pests of cultivated and wild plants and stored products in the three parts of Libya concerned, showing their distribution there, followed in the first two by information on the individual species and their control.

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MARTIGNONI (M. E.) & LANGSTON (R. L.). **Supplement to An annotated list and bibliography of insects reported to have virus diseases.**—*Hilgardia* **30** no. 1 pp. 1–40, 473 refs. Berkeley, Cal., 1960. [*Cf. R.A.E.*, A **46** 386.]

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NIELSEN (E. T.) & NIELSEN (H. T.). **Temperatures preferred by the Pierid** *Ascia monuste* **L.**—*Ecology* **40** no. 2 pp. 181–185, 4 graphs, 5 refs. Brooklyn, N.Y., 1959.

NAYLOR (A. F.). **An experimental analysis of dispersal in the flour beetle,** *Tribolium confusum.*—*Ecology* **40** no. 3 pp. 453–465, 3 figs., 16 refs. Brooklyn, N.Y., 1959.

HERFS (A.). **Termiten und Silberfischchen als Papier- bzw. Bücherschädlinge.** [Termites and silverfish as pests of paper or books (a review of the literature).]—*Anz. Schädlingsk.* **32** pt. 12 pp. 178–181, 3 figs., 34 refs. Berlin, 1959.

OLDIGES (H.). **Der Einfluss der Temperatur auf Stoffwechsel und Eiproduktion von Lepidopteren** (*Lymantria monacha* **L.**, *Panolis flammea* **Schiff.**, *Bupalus piniarius* **L.**, *Achroia grisella* **Fabr.**, *Galleria mellonella* **L.**). [The influence of temperature on the metabolism and egg production of Lepidoptera (*L. monacha*, *P. flammea*, *B. piniarius*, *A. grisella* and *G. mellonella*).]—*Z. angew. Ent.* **44** pt. 2 pp. 115–166, 20 graphs, 97 refs. Hamburg, 1959. (With a summary in English.)

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NOTICES

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Printed in Great Britain by The Eastern Press, Ltd., London and Reading